Mariners Weather Log

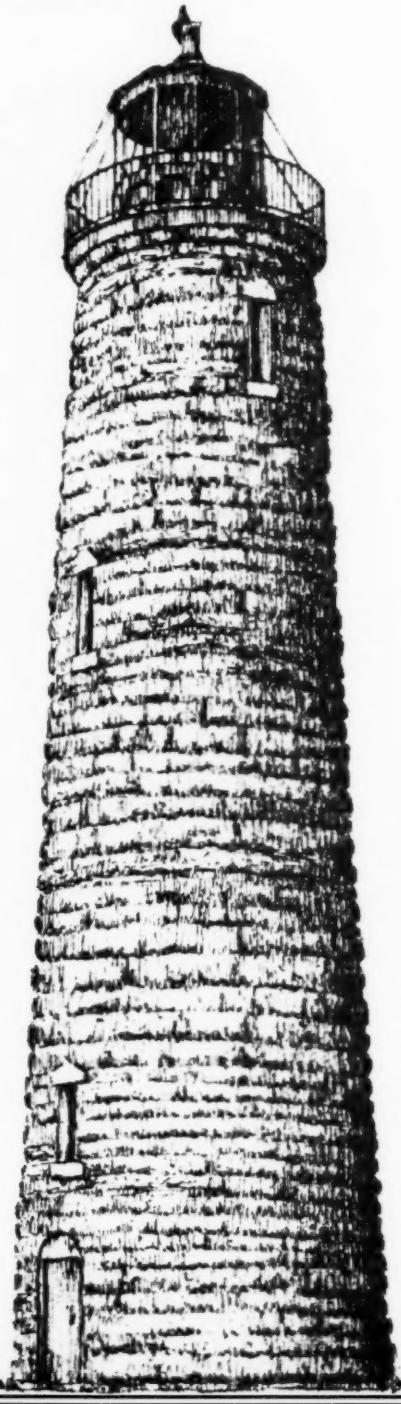
Spring 1994

Burlington Bay Light

Lake Ontario

Burlington, Ontario, Canada

Pen and Ink Drawing by Leo Kuschel
Descriptive passage by Leo and Sue Kuschel



On the western extremity of Lake Ontario in 1838, the first lighthouse was built on this site. In 1858 it was replaced by the tower depicted in this drawing. In 1961 this light was decommissioned although it is situated at the opening to the busy Burlington Cut. It was expendable as it was dwarfed by the Burlington Skyway and lift bridge similar to the case of Old Makinac Point Light.

The tower is made of stone 16.8 meters (55 feet) tall with four landings connected with stairs. Windows are at each landing. The destruction of this light has been stopped so far by the efforts of our good friends Mary Weeks–Mifflin and Ray Mifflin, of Burlington, Ontario, who have written *Harbour Lighthouse*, the complete history of this light station. These excellent writers and historians also wrote *The Light on Chantry Island*.

Historical Society of Michigan
2117 Washtenaw Av.
Ann Arbor, MI 48104

MarinersWeather Log

Spring 1994
Vol. 38, No. 2

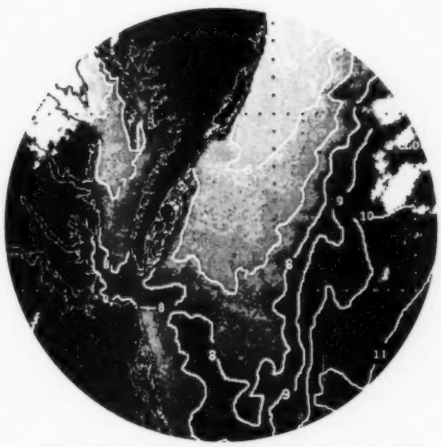
Saugerties Light— page 34

4
Canadian West Coast Giant Waves
Jim Gower & David Jones
World class West Coast waves

10
North Atlantic Hurricanes— 1993
Edward N. Rappaport & Richard J. Pasch
Arlene to Harvey, they're a wild bunch

17
Eastern North Pacific Hurricanes— 1993
Max Mayfield & Lixion Avila
Ships play important role in tracking storms

26
Massachusetts Maritime Academy
Nancy O'Donnell
Building mariner/meteorologists of the future



Water temperature by satellite— page 40

Cover: Canada's Bonilla Island Lighthouse in Hecate Strait, British Columbia is no stranger to giant waves even though it stands 37 meters above high water. During the December 20, 1991 storm the lighthouse keeper reported spray from breaking waves. Photo courtesy of Abe Van Oeveren of the Canadian Coast Guard.

Back Cover: The ***Tabasco was*** one of our outstanding weather reporting ships and a SEAS vessel. Owned and operated by Mexico's TMM, the ***Tabasco*** sank in a fierce storm in the North Atlantic. All crew members were safely evacuated. Photo by Jim Nelson, PMO Houston.

Departments

9 Mail Call
25 Scuttlebutt
32 Lifelines
34 Whale Oil & Wicks
36 Marine Observations
39 Sea Photo
40 Satellite Snapshots
41 Great Lakes Wrecks
42 PMO Poop
46 Hurricane Alley
50 Fax Facts
52 Editors' Choice
54 Radio Tips

Marine Weather Review
October, November and December 1993

57 North Atlantic Weather
62 North Pacific Weather
67 Pressure and Track Charts
76 Tables

Mariners Weather Log

Editor
Richard M. DeAngelis

Associate Editor
Nancy O'Donnell

Columnists
Elinor DeWire
Marty Baron
Michael Halminski
Skip Gillham

Computer Specialists
Gary Keull
Wilbur Biggs
Dick Knight

Satellite Coordinator
Jenifer Clark

U.S. Department of Commerce
Ronald H. Brown, Secretary

National Oceanic and Atmospheric Administration
Dr. D. James Baker
Administrator

National Environmental Satellite, Data, and Information Service
Robert S. Winokur, Assistant Administrator

National Weather Service
Elbert W. Friday Jr., Assistant Administrator

National Oceanographic Data Center
Bruce C. Douglas, Director

The Secretary of Commerce has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through July I, 1994.

The ***Mariners Weather Log*** (ISSN:0025–3367) is published quarterly by the **National Oceanographic Data Center**, National Environmental Satellite, Data, and Information Service, NOAA, Washington DC 20235 (telephone: 202–606–4561). Funding is provided by the National Weather Service, NOAA. Data is provided by the **National Climatic Data Center**, NOAA.

Articles, photographs and letters should be sent to:

Editor, Mariners Weather Log
National Oceanographic Data Center
1825 Conn. Av., NW
Washington DC 20235.

"... and kilometers to go before I sleep."

You may have noticed our increased use of metric measurements. Actually this is an attempt to use terms most familiar to mariners throughout the world. Since there are just two countries where the metric system is not in use, "the time has come the walrus said ... ." Our conversion is more *nauticspeak* than metric. This is why you will see the frequent use of Beaufort Force– long recognized as the mariner's way to estimate or even talk of wind speed. Knots and Beaufort Force will be used interchangeably as most mariners use them. Also in keeping with tradition, miles are nautical miles and time is Universal Coordinated Time (UTC) unless otherwise noted. UTC was formerly known as Greenwich or Zulu (Z) time and will occasionally turn up that way on some charts. If more changes are needed to make our publication more readable to the mariner, they will be made.

The English language is composed of a great many nautical terms; many of the more colorful ones have been adapted by landlubbers. Some are so common as to be overlooked and others are more oblique. Obvious phrases include *squared away, ship shape, three sheets to the wind* and *knowing the ropes*. Less obvious phrases include *stick in the mud*. It is theorized that this was derived from the practice of hanging pirates in Elizabethan England. This was often done at the desolate Thames tidewaters and the felon buried in the mud "so that none may find his foul body nor account for his soul at the resurrection." Today it stands to mean someone who is deadly dull.

Another commonly used nautical phrase is *posh*. Taking the great English passenger lines to India, travelers found that they were most comfortable by finding shade during the hottest part of the journey. This turned out to be portside cabins on the way out and starboard on the return trip. For those that could afford it, the abbreviation stamped on the ticket was POSH– port out, starboard home. This term became a synonym for luxurious. Then, there is the admonition to children to *mind your Ps and Qs*. Tavern keepers developed a method for keeping sailor's bar tabs while they were in port. It involved a chalk board where P stood for pints while Q represented quarts. Some unscrupulous keepers would chalk up the wrong column on occasion so sailors were advised to *watch their Ps and Qs*.

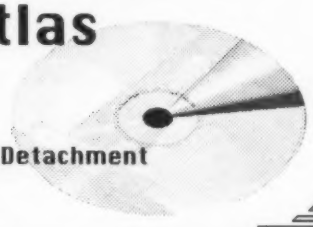
In addition to our measurement conversion in the Log we are also attempting to make the articles and columns cleaner, shorter and more readable. This is of course an ongoing concern, but once in awhile a dramatic move is necessary. Also, in response to a number of requests, we are going to add more about the use and reception of radiofacsimile charts. The National Weather Service has recognized their importance to the mariner and is actively attempting to improve the quality and quantity of these charts. This is an honest effort, so any suggestions or criticisms that you may have about these products will be appreciated. Just write directly to Dave Feit, Marine Forecast Branch, NWS, NOAA, World Weather Building, 5200 Auth Road, Camp Springs, MD 20746. We will also forward your comments if you write to the *Mariners Weather Log*.

–Editor

NOW ON CD–ROM

Global Tropical/Extratropical Cyclone Climatic Atlas

Version 1.0, March 1994



Jointly produced by
Fleet Numerical Meteorology and Oceanography Detachment
National Climatic Data Center

The CD–ROM

The CD-Rom provides a menu of user-defined options on time, area, and type display (with print capability) of the two historical data files. CD–ROM displays are independently based on each file. System requirements include IBM 286, 386, 486 or compatible PC, EGA graphics card, 520K of RAM, MS–DOS version 3.21 or higher, CD–ROM drive with Microsoft CD extensions and a Microsoft compatible mouse.

Extratropical Cyclone (XT) File

Provides 405,731 hourly records for 35,741 extratropical cyclone tracks for the Northern Hemisphere during 1965-93.

Tropical Cyclone (TC) File

Contains unique hourly tropical cyclone track data for each of six ocean basins: North Atlantic (ATL), Eastern North Pacific (ENP), Western North Pacific (WNP), North Indian (NI), Southwest Indian (SWI), and Southwest Pacific (SWP). Narratives are included for most tropical cyclones in all ocean basins for 1980-1992.

The database

The GTECCA data base is a compilation of historical digital tape deck data files archived at the NCDC. Tropical cyclone data were also provided by the Joint Typhoon Warning Center (JTWC) and by the Regional and Specialized Meteorological Centers (RSMC) participating in the World Meteorological Organization's (WMO) Tropical Cyclone Program.

How to order

Send $100.00 plus $11.00 shipping and handling to National Climatic Data Center, Climate Services Division, Mail Stop M1, Federal Building, 37 Battery Park Avenue., Asheville, NC 28801-2733.

Please send me the following CD–ROM:

U.S. Navy– Department of Commerce Global Tropical/Extratropical Cyclone Climatic Atlas

COST: Number of discs__X $ =_____

METHOD OF PAYMENT:

☐ **Check (drawn on a United States bank and payable to "Department of Commerce/ NOAA/NODC")**

☐ **Money order**

☐ **Visa** ☐ **MasterCard** **Exp. date_____**

Card number _____

Signature _____

SHIP TO:
Name _____

Organization_____

Address _____

City_____ **State**_____

Zip _____

Country_____

Canadian West Coast Giant Waves

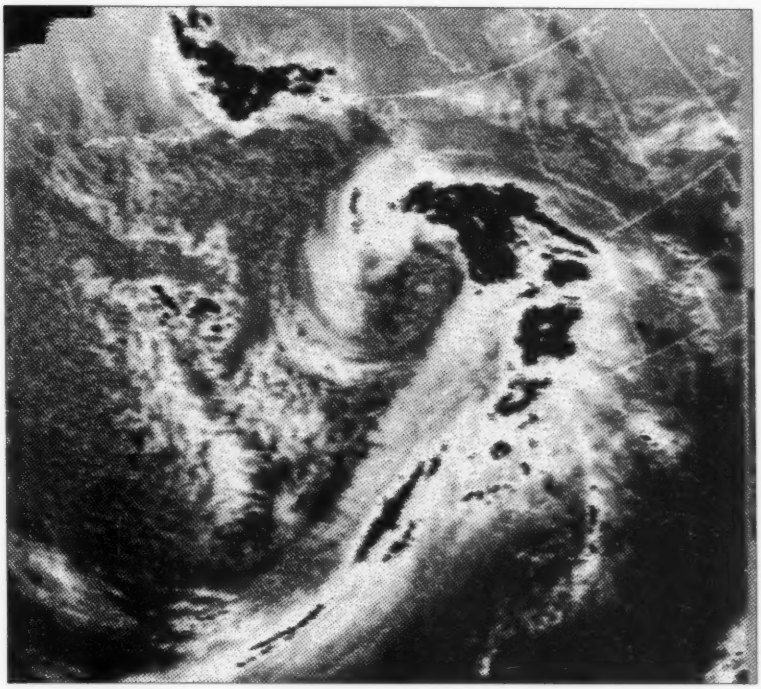
Dr. Jim Gower, Department of Fisheries and Oceans
and David Jones, Environment Canada

On December 10, 1993, the biggest storm of the season blasted coastal British Columbia with winds of more than 64 knots gusting to 100 knots. In a rare occurrence, hurricane force wind warnings were issued for no less than four separate marine areas around northern Vancouver Island. Near midnight on December 10, the East Dellwood buoy, 70 miles west of Cape Scott, recorded a maximum wave of 30.8 meters (101 feet). A record wave had arrived! Or had it?

How big are the biggest West Coast waves? Mariners, oceanographers and meteorologists have long pondered the question. In the past, finding out first hand had been a dangerous business. Most stories of giant waves came from the surviving crew members of resilient and fortunate vessels. Terrified oil-rig workers recount their own tales of waves breaking over platforms at unbelievable but verifiable heights. Unfortunately, some stories will never be told.

In January of 1987, the ***Scotia Cape***, a 36–meter, 390–ton stern trawler equipped with radios, survival suits, radar and two lifeboats, disappeared. No distress signals were received, no trace of the ship was ever found. It was last seen heading west into heavy seas near the northern tip of Vancouver Island. Investigators concluded that whatever happened to the ***Scotia Cape***, happened very suddenly and without warning. Transport Canada's report on the incident states that "The loss of the ***Scotia Cape*** and her seven-man crew occurred in an unknown position... the reason for the loss is not known." The report notes that freak or giant waves have been observed around northern Vancouver Island.

Bonilla Island lies about 80 kilometers (50 miles) south of Prince Ruppert and 15 kilometers (9 miles) west of Banks Island in the Hecate Strait. Bonilla Island Lighthouse (photograph to the left) was the scene of one of the giant waves off British Columbia. The most recent giant wave occurred in conjunction with a wicked 952-millibar storm on December 10, 1993. The infrared satellite photograph (right) was taken on the 9th of December.



Around the globe, reports of huge waves were met with skepticism until a qualified observer aboard the U.S.S. ***Ramapo*** measured an enormous 34-meter (112 foot) wave in the North Pacific in 1933.

After a 1984 Pacific storm in which several fishermen lost their lives, Environment Canada—with the help of the Department of Fisheries and Oceans and the Canadian Coast Guard—began installing a network of offshore, moored marine-weather buoys. The objectives were simple: better marine weather forecasts and more timely warnings. By 1989, continuous and reliable measurements of West Coast waves were available from 8 offshore buoys. The network has since expanded to 16 buoys. Wave and weather information are relayed to land stations via satellite within minutes.

It is now apparent that West Coast waves are world class in size. And recent observations suggest that *freak* waves may occur more frequently than was earlier believed.

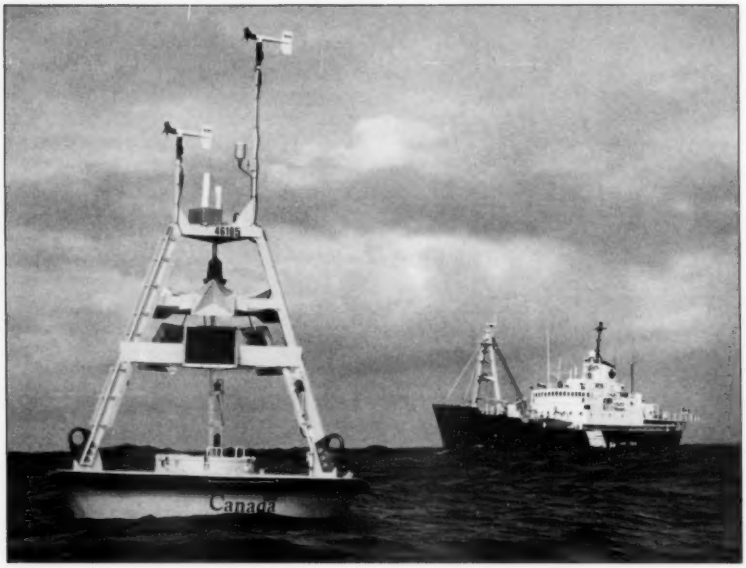
Waves form and grow as the wind transfers energy from the atmosphere to the sea. The overall sea state is a complicated combination of wind-driven wave trains and swells (which are just decaying waves coming from distant storms) of differing heights, lengths and directions. When several wave trains converge to a point, the resultant wave may be much larger than the surrounding waves. Occasionally, the resultant wave may seem outrageously disproportionate— hence the expression *freak wave*.

The danger of these waves is not simply due to the incredible height of the crest above the trough. Their sudden growth results in very steep sides. Survivors have described the steep trough ahead of or behind a freak wave as a "hole in the sea." The wave itself is often described as an "overhanging" wall of water that seemed to stretch from horizon to horizon. The rapidity with which these waves develop and the direction from which they approach a vessel adds to the hazard.

The interaction of the seas with prevailing tidal and ocean currents and the sea-bottom can create especially conducive conditions for freak wave development. The Cape of Good Hope off the southern tip of Africa is notorious for massive and occasional freak waves which result from the interaction of

Dr. Jim Gower has worked at the Federal Institute of Ocean Sciences (Department of Fisheries and Oceans) in Sidney, B.C. since 1972. His main interest is in using satellites to study waves and other properties of the ocean surface.

David Jones is a meteorologist at the Pacific Weather Centre in Vancouver. He has worked as a marine forecaster on both Canada's coasts. He is now a media representative for Environment Canada on the West Coast.



Buoy 46185 resides in the South Hecate Strait. The Canadian Coast Guard vessel ***Narwhal*** *can be seen in the background (left). These buoys are serviced by the Canadian Port Meteorological Officers. At this location, a 30.4-meter wave was measured. This buoy is similar to the one that measured the potential record.*

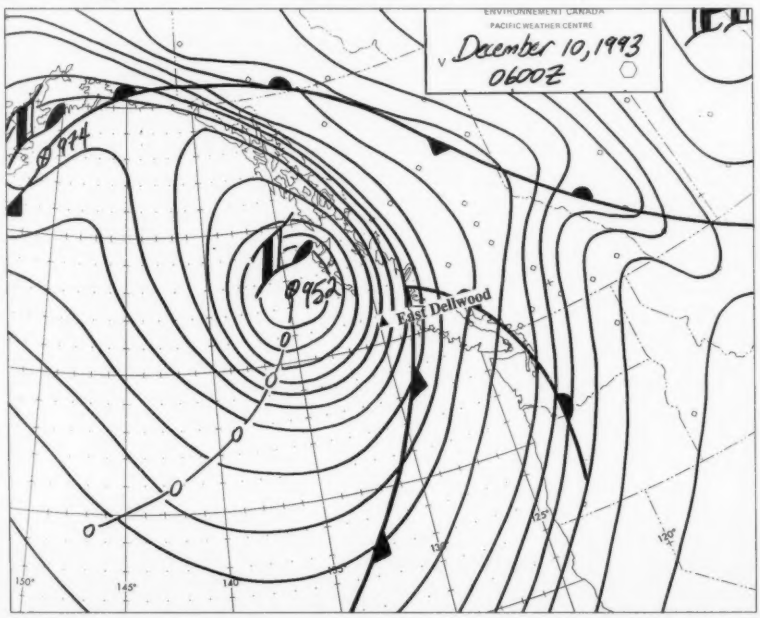
The surface analysis (below) was made at 0600 UTC on the 10th of December at the storm's peak. East Dellwood off Vancouver Island marks the location of the buoy that made the measurement of 30.8 meters.

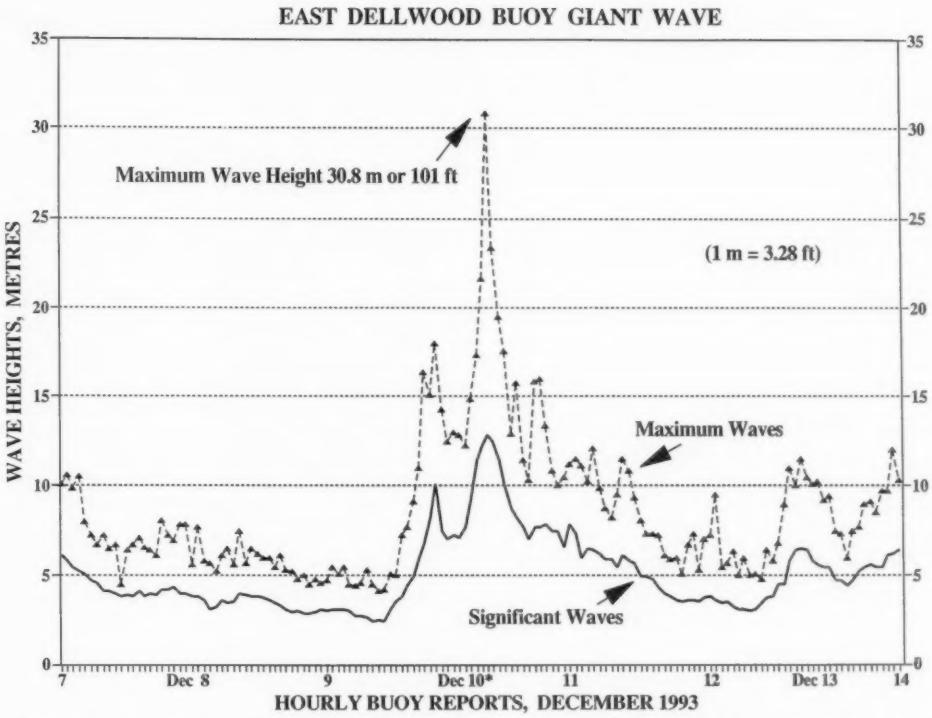
stormy seas and the Agulhas current. It has been suggested that in the infamous Bermuda Triangle—where the Gulf Stream meanders—the missing ships may have encountered freak waves. While ocean currents along the west coast of North America are weak, monster waves develop when intense Pacific storms generate huge seas. Occasionally, these monster waves are observed and reported.

On October 22, 1968, SEDCO 135F, an oil-drilling rig anchored just west of Cape St. James, was battered by 20-meter (65 foot) waves. As a monster wave approached, a lower support form of the rig was exposed. The following wave crest passed just below a control room located 30.5 meters (100 feet) above the support form. More recently, Pacific storms have produced gigantic waves—perhaps the largest ever measured by instruments— just offshore.

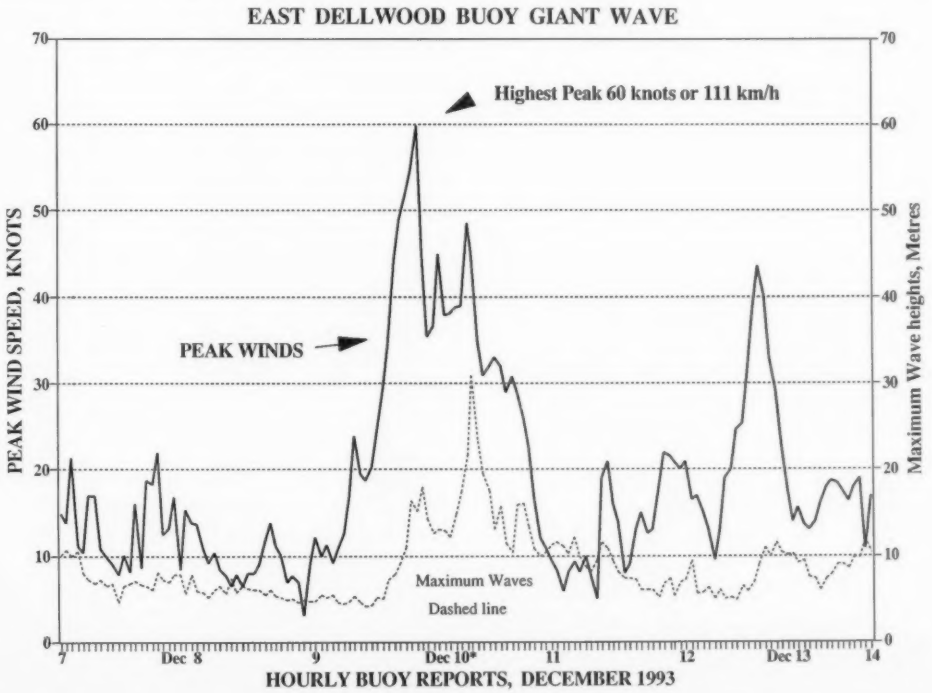
During a major storm on December 20, 1991, Environment Canada forecasters were astonished when the South Hecate buoy, about 50 miles east of Cape St. James, recorded a maximum wave height of 30.4 meters (100 feet). None of the marine forecasters could recall seeing observations of such a large wave. At its peak, Jean Beaudet, the lighthouse keeper on Bonilla Island near the mainland coast, reported that spray from breaking waves was flying over the top of the lighthouse at Bonilla— a height of about 37 meters (120 foot) above high water!

On December 13, 1992 during a similar winter storm, the West Dixon Entrance buoy, about 30 miles west of Dixon Entrance, was swamped by a 26-meter (85 foot) wave that destroyed the buoy's anemometers. Oceanographers at the Institute of Ocean Sciences at Sidney on Vancouver Island hauled out the *Guinness Book of World Records* and duly noted that the highest wave ever recorded by an instrument was 26.2 meters (86 feet), measured by an Atlantic




EAST DELLWOOD BUOY GIANT WAVE
Maximum Wave Height 30.8 m or 101 ft
(1 m = 3.28 ft)
Maximum Waves
Significant Waves
WAVE HEIGHTS, METRES
HOURLY BUOY REPORTS, DECEMBER 1993

The chart above compares the variation of the maximum wave heights with the significant wave heights from December 7 to December 14, 1993. The chart below compares the peak wind speed to the maximum waves. The maximum wave height occurred well after the peak gust but during the period of the strongest winds. This region is the very same where the USCG icebreaker Polar Sea *ran into a series of "three sister" waves back in October of 1985 (*Mariners Weather Log, *Volume 30, Number 4) resulting in one death and two injuries.*



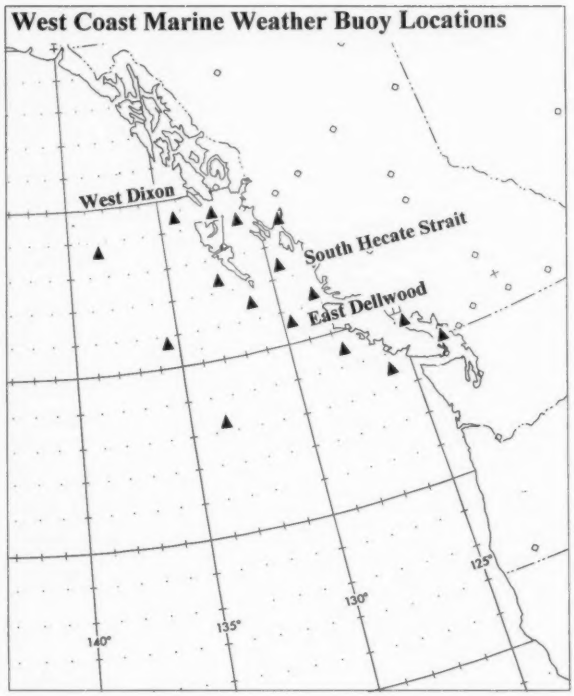
weather ship in 1972. Although disappointed at just missing the record and not realizing that a record was already within their grasp from the South Hecate Buoy in 1991, oceanographers and meteorologists alike began to look ahead for a potential record. No matter. Just 1 year later the East Dellwood buoy checked in with a maximum wave of 30.8 meters (101 feet). This was a potential record, but was it accurate?

West Coast weather buoys do not measure the trough-to-crest height of waves. An enclosed accelerometer measures the vertical acceleration of the buoy as it bobs on the surface. An algorithm converts the measured acceleration to a sea height. In heavy seas, the accelerometer may respond to violent sideways forces from a breaking wave, thereby confusing horizontal and vertical accelerations and overestimating wave heights.

The sea state is defined by the average height of the highest one third of the waves. This figure is referred to as the significant wave height. It is generally agreed that the significant wave corresponds closely to a visual estimate of average wave heights. The extreme wave in a group is typically about twice the significant wave of the group. Marine forecasters at the Pacific Weather Centre have suggested that the East Dellwood giant wave of 30.8 meters seems suspiciously high, given that it occurred with a significant wave height of only 12.3 meters.

But it is also possible that the waves were larger than recorded by the buoys. Canadian West Coast buoys were designed to measure waves with a vertical range of about +15 meters, corresponding to a maximum trough-to-crest height of roughly 30 meters. The measurements of 30.4 and 30.8 meters mentioned above were probably *clipped* by this limit. Perhaps the vertical range of the buoys needs to be extended for our robust wave climate. Furthermore, some observations of buoys in heavy seas suggest that, although they are easily carried to the deepest troughs, buoys seem to resist being carried to the highest peaks of waves, preferring to skirt round slightly to the side.

Finally, accurate wave height calculations depend upon the calibration of the accelerometer. Normally the buoys are tested by moving them around a 2-meter (6 foot) vertical circle that mimics the buoy's movement in small waves. The giant waves are 15 times larger. The mooring designs will be re-checked to see how the buoys respond under extreme conditions. After the Ocean Ranger oil-platform disaster on the East Coast, the buoy nearest the rig at the time of the mishap was tested by Ron Wilson, a DFO scientist. The buoy was taken to Ottawa and strapped to a 22.9-meter (75 foot) Ferris wheel. It was found to be accurate to within 1%.



The bottom line is we cannot be as certain as we would like to be that the buoys detected 30 plus meter waves, nor can we rule out the possibility that even larger waves are occurring. Our present best estimate is that the buoys are just about right.

Observations of freak waves are rare. Their life is brief, lasting only a minute or two. Forecasting them is impossible. On the West Coast, freak waves may develop after an extended period of storm or hurricane force southerly winds. These waves have been observed in the offshore waters, in Queen Charlotte Sound and in southern Hecate Strait, which has a long and open fetch to the south.

Record or not, it is now clear that West Coast storms occasionally produce some of the largest waves in the world. Before the installation of the buoy network, it was generally believed that 25 to 30 meter waves were extremely rare on the West Coast. A recent (1992) publication entitled *Wind/Wave Hindcast Extremes for the West Coast of Canada* that was based upon limited buoy data suggests that 25-meter waves have a return period of 100 years. Given that three gigantic waves have been observed by buoys in the past 3 years, it seems that monster waves occur much more frequently than was previously believed.

Letter From London

I must extend my compliments on your Fall 1993 "Wave Issue" I am a sea-going Safety Consultant with 36 years of sea-going experience and I found the issue both informative and entertaining. I am at present on board a vessel that has no English reading material at all. When I found your publication on the Bridge I seized it, and bearing it off to my cabin, read it from cover to cover– twice.

Two points I questioned were the state of Scylla and Charybdis ["Solitary Waves" by Irving] and the date of the ***Waratah*** disappearance ["High Waves in the Agulhas Current" by Shillington and Schumann].

The whirlpool Scylla and Charybdis is a very shadow of its former self, if visible at all. The Pilot Book mentions that a severe earthquake in the late 1800's altered the configuration of the bottom, and although several rip tides are visible I have never seen anything that would even inconvenience a small Phoenician trader. Surely it was a misprint in the date of the ***Waratah*** disappearance, Jeffrey Jenkins used the ***Waratah*** and Agulhas freak waves as the main plank of his novel '*Scend of the Sea* long before 1990.

I personally have been lucky in my time at sea and have not come across anything like a "Big One," but I have in the last few years visited vessels that shortly before had had that dubious pleasure.

In the first instance an American Flag O.B.O. of the San Clemente class had been proceeding towards the New York area and at the time of the encounter was about 180 miles off. Sea conditions were reported as being "a bit rough, winds force 7–8." The Chief Mate on watch on the 4–8 reported that "it just fell into a hole in the sea, and was then hit by the following wave that buried the ship to well aft of the cargo manifold." The ship was lucky and suffered only a bent foremast. With hindsight it must have been somewhere around the Gulf Stream area at the time.

The second case involved a British Reefer vessel homeward bound from the Caribbean area and was, at the time, just north of the Azores. Again with a force 7–8 wind and again on the 4–8 watch. The Chief Mate on watch had just walked into the Chartroom when "the bow fell into a hole in the sea." The following wave stove in the Bridge-front windows, at about 60 feet above sea level and propelled sharp shards of glass into the after bulkhead. The Mate was quite pleased that he wasn't standing where he had been only a few moments before! The satellite dome above the Bridge was demolished and a cabin below the bridge had windows smashed and furniture rendered to matchwood by the force of the water. Fortunately, no one was seriously injured, and even more fortunately the free surface effect of the water that entered the accommodation was not catastrophic. I can think of several Reefer ships with critical stability that would not have survived such free surface moments. In all probability they would have joined the "lost without trace" legion.

The article on "How High Can Giant Wave Get?" had a severe effect on my digestive tract and if 219-foot high waves do exist, then I am quite prepared to take Dr.Goldman's word for it. First-hand knowledge I am fully prepared to leave to others.

Archie K. McLaren's final comment that "No ship's Captain would ever find himself facing a hurricane like the one the ***Madison*** did back in 1930. All ships would make a wide detour to avoid such weather, having been forewarned," is obviously meant to reassure prospective passengers, but is sadly just not true. While Masters will do everything in their power to avoid typhoons and the like, some unfortunates will find themselves in an area with nowhere to go, and nothing to do but grin and bear it. Perhaps after reading the ***Mariners Weather Log*** they will, however, have a better chance of coming through it.

M.B.Harvey. M.N.I.
Leytonstone, London, England

North Atlantic Hurricanes – 1993

Edward N. Rappaport and Richard J. Pasch
National Hurricane Center

For the third consecutive year, the Atlantic hurricane basin had fewer than the 50-year average of ten tropical storms and six hurricanes. During 1993, there were eight storms and four of those became hurricanes. With the exception of Emily, the hurricanes were short-lived and did not reach "major hurricane" status. Also, the activity ended earlier (September 21) than any hurricane season since 1930. Despite the relatively small number of systems, cyclones claimed 280 lives this year (seven of these deaths occurred in Cuba as a result of one of the two tropical depressions in 1993). Ship reports and other maritime weather observations once again provided critical information to the National Hurricane Center (NHC).

Tropical Storm Arlene

Arlene formed in an area of clouds and thunderstorms that moved over the western Caribbean Sea during the second week of June. This system dropped locally heavy rains that, in El Salvador, caused a landslide that killed 20 people.

Data from surface stations and a U.S. Air Force Reserve reconnaissance plane indicated that a 1008-millibar low pressure system had developed over the Yucatan Peninsula by midday on the 17th. Thunderstorms organized in bands and, by late that evening, the weather system became a tropical depression.

The depression was embedded in a moderate southwesterly vertical wind shear which prevented thunderstorms from becoming concentrated near the circulation center but satellite pictures indicated that thunderstorm bands 100 to 200 miles north and east of the center were strengthening. Reports by the ***Davao Trader***, several oil industry platforms, and a buoy showed increasing sustained wind speeds. By early on the 19th, aircraft data and satellite pictures indicated that a new circulation with a 1000 millibar pressure center had formed about 100 nautical miles northwest of the original center. This system became Tropical Storm Arlene.

Arlene moved slowly toward the lower Texas coast and made landfall on Padre Island, about 40 miles south of Corpus Christi, on the morning of the 20th. It dissipated slowly, but heavy rains continued. Rainfall totals of up to 376.4 millimeters (14.82 inches) were recorded (at Henderson, Texas) from the combined effects of Arlene and a nearby frontal system. Associated flooding claimed one life in Henderson and five others in Mexico. Although no tropical storm force winds were reported from land stations, storm tides locally up to 1.2 meters (4 feet) were generated along the Texas coast. The surge caused tidal flooding and some beach erosion as far as the southwestern Louisiana coast. Damages in the states of Texas and Campeche, Mexico were estimated at $22 million and $33 million, respectively.

Tropical Storm Bret

The precursor to Bret was a westbound tropical wave that crossed the coast of Africa on the 1st of August. By early on the 4th, centered about 1000 miles southwest of the Cape Verde Islands, it reached tropical depression status and, a day later, became Tropical Storm Bret.

Edward Rappaport and Richard Pasch are Hurricane Specialists at NOAA's National Hurricane Center in Miami, FL. Also contributing to this report were their fellow Specialists Lixion Avila, Miles Lawrence, and Max Mayfield. The analyses incorporated data provided by Michael Burdette of the NOAA National Data Buoy Center and Alberto Unzon of the "Servicio Meteorologico de Mexico."

Hurricane Emily was a classic tropical cyclone. By the 1st of September, the storm had reached its peak and was beginning to recurve away from the Outer Banks of North Carolina but into the major shipping lanes.

Bret moved westerly at nearly 20 knots for several days. The storm's peak 50-knot winds and minimum pressure of 1002 millibar occurred on the 7th near Trinidad. That same day the bark ***Lady Elaine*** observed a sustained wind of 40 knots while anchored off the south coast of Grenada. The center continued westward, occasionally clipping extreme northern Venezuela, where heavy rainfall totaled as much as 339.1 millimeters (13.35 inches) in 10 hours. Catastrophic flooding and mudslides occurred in the Caracas area. At least 173 people died in Venezuela.

Bret's center moved over northernmost Colombia on the night of the 8th-9th, causing one death there. The circulation was disrupted by Pico Cristobal Colon, Colombia's 5790-meter (19,000 foot) north coast mountain, so Bret entered the southwestern Caribbean Sea disorganized. It reintensified and maximum winds reached 40 knots when its center crossed the southern Nicaragua coast around noon on the 10th. A total of 10 deaths occurred in Nicaragua. Ham radio reports indicate that nine of the fatalities occurred when a boat from Spain sank near Isla de Maiz.

Bret then turned toward the west northwest and weakened. A remnant disturbance eventually developed into eastern North Pacific Hurricane Greg.

Tropical Storm Cindy

Cindy was the only storm to affect the northeastern Caribbean Sea in 1993. After tracking westward over the North Atlantic for nearly a week as a tropical wave, a reconnaissance flight detected a low-level circulation on the 14th. It was estimated that the system became a tropical depression early that day about 60 miles to the east of the southern Leeward Islands.

Low and middle level winds carried the depression toward the west northwest. Near midday on the 14th, the system reached Martinique where, as Tropical Storm Cindy, it caused flooding resulting in two deaths and several million dollars of property damage. Cindy reached its peak intensity of 40 knots early on the 16th, about 75 miles to the southeast of Santo Domingo, Dominican Republic. A reconnaissance aircraft measured Cindy's lowest central pressure, 1007 mb, on the morning of the 16th and encountered a large area of 35 to 50 knot winds at the 455-meter (1500 foot) flight level.

Cindy weakened and then dissipated over the high terrain of Hispaniola on the 17th, but was blamed for two deaths and two missing persons in the Dominican Republic.

1993 Atlantic Hurricane Season Statistics

no.	name	class[a]	dates[b]	maximum sustained wind(knots)[c]	lowest press. (mb)	U.S. damage ($millions)	deaths[d]
1	Arlene	T	Jun. 18-21	35	1000	22	6
2	Bret	T	Aug. 4-11	50	1002		184
3	Cindy	T	Aug. 14-17	40	1007		4
4	Dennis	T	Aug. 23-28	45	1000		
5	Emily	H	Aug. 22-Sep 6	100	960	35	3
6	Floyd	H	Sep. 7-10	65	990		
7	Gert	H	Sep. 14-21	85	970		76
8	Harvey	H	Sep. 18-21	65	990		

a ST: subtropical storm, wind speed 34-63 knots.
T: tropical storm, wind speed 34-63 knots.
H: hurricane, wind speed 64 knots or higher.
b Dates begin at 0000 UTC and include tropical depression stage.
c Wind speed over a one-minute span.
d Tropical Depression One caused 7 deaths over Cuba.

Tropical Storm Dennis

Dennis formed over the far eastern tropical Atlantic on August 23 from a broad area of low pressure accompanying a tropical wave. The system gradually strengthened and then had a maximum intensity of 45 knots on the 25th and most of the 26th. During this period its track was generally west northwestward.

A mid- to upper-level trough northwest of Dennis created a shear pattern in which the storm's deep convection gradually diminished. By the 27th, shearing and cooler sea-surface temperatures weakened Dennis to a depression. It dissipated a day later.

Hurricane Emily

Emily was the year's first, strongest, and longest-lasting hurricane. It originated as a tropical wave that moved from the Cape Verde Islands on August 17 to about 700 miles east northeast of Puerto Rico, where it became a tropical depression on the 22nd.

The depression became Tropical Storm Emily on the 25th and nearly stalled about 350 miles southeast of Bermuda. At 7 A.M. AST on the 26th,the ***OMI Missouri*** made a special ship-to-shore call to the NHC. The vessel, some 50 miles southeast of Emily's center, reported Beaufort Force 12 (64 knot) winds from the southeast with gusts to 85 knots– strongest winds reported by a ship in an Atlantic tropical cyclone this year. They also indicated "mountainous" seas for the preceding 2 hours. Their report indicated that Emily was (briefly) a hurricane that day.

On the 27th, Emily regained hurricane intensity and began to move westward around the south side of a high pressure ridge. Over the following 3 days, a short-wave trough and ridge passed by to the north, turning the track northwestward and then westward again, toward the North Carolina coast. Wind speeds remained near 70 knots through that period.

Yet another trough in the westerlies neared Emily on the 31st, and the hurricane, then less than 100 miles southeast of the Outer Banks, began to turn northward. Reconnaissance aircraft data indicated that Emily had become a major hurricane, with 100-knot 1-minute surface winds and a central pressure near 960 millibars when the center of Emily's eye passed northward only about 20 miles offshore from Hatteras Island on the evening of the 31st. Nevertheless, a portion of Emily's western eyewall moved across the island, making Emily a "hit" (not a landfall) for Hyde and Dare Counties of North Carolina. The 1-minute winds on Hatteras Island are estimated to have been between 65 and 100 knots. Strongest winds speeds near the surface, however, were measured at Diamond Shoals Light Tower (located about 15 miles southeast of Cape Hatteras) at an elevation of 46.6 meters (153 feet). There, 89-knot winds with a gust to 128 knots were recorded, along with a minimum pres-

sure of 964.5 millibars. The winds generated a storm surge as high as 3.1 meters (10.2 feet) on the Pamlico Sound side of Hatteras Island, and about .6 meter (2 feet) on the Atlantic side. Rough surf claimed two lives at Nags Head, North Carolina and another along the Virginia coast. A preliminary damage estimate for North Carolina is $35 million.

The hurricane became temporarily entrained in the westerlies and quickly turned away from land while beginning to weaken on the 1st of September. From late on the 3rd through the 5th, however, Emily was quasi-stationary about 750 miles to the south of Newfoundland. At the end of that period, Emily had weakened to a northeastward-moving depression. About a day later, it lost its tropical characteristics and dissipated.

Hurricane Floyd

Several ship reports implied that a well-defined low-level circulation was embedded in a tropical wave when it left the west coast of Africa on the 28th of August. Despite this advanced degree of organization, deep convection did not become persistent for over a week until the wave was moving northwestward to the north of the Leeward Islands on the 6th of September. The following day, the system became a tropical depression and then Tropical Storm Floyd, as suggested by the 58-knot winds measured aboard a reconnaissance aircraft at a flight level of 1500 feet.

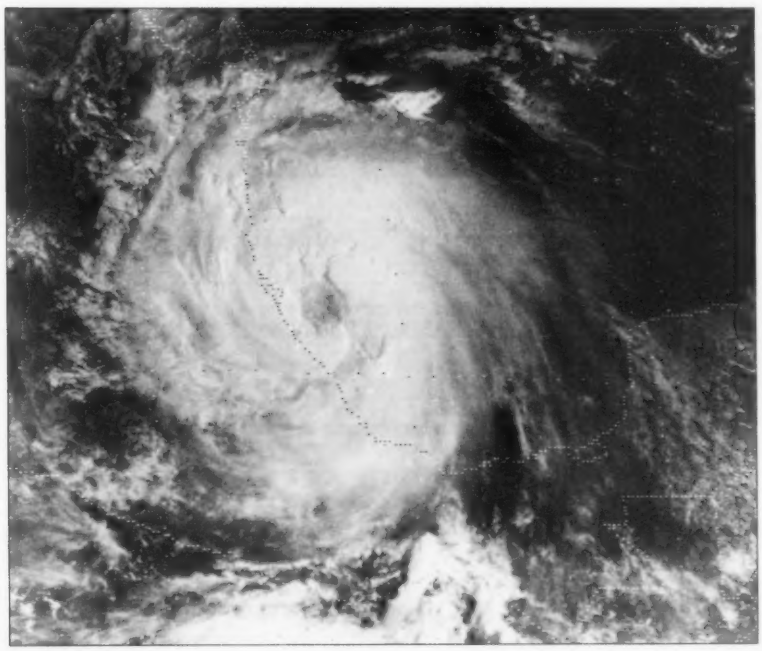
Floyd accelerated northward and was moving at about 20 knots when its center passed about 200 miles to the west of Bermuda on the 8th. That night saw the end to strong southwesterly vertical wind shear that had been stripping thunderstorms away from Floyd's center. By morning, the circulation center was near the center of a convective overcast, indicating that Floyd had strengthened. At 4 P.M. EDT, the center passed about 40 miles to the northwest of Canadian buoy 44141. The buoy reported a pressure of 998 millibars, a sea-surface temperature of 27.1°C, and a 2-minute wind speed of 60 knots during the preceding hour. The buoy report and a transitory appearance of a possible eye on satellite pictures indicated that Floyd probably reached hurricane status with 65-knot winds on the 9th.

Floyd continued to accelerate and was moving generally east northeastward at about 45 knots when it became extratropical over the cooler waters of the north-central Atlantic late on the 10th. Its center passed near the ***Cast Muskox***, which measured sustained winds of 50 knots and a 994.0-millibar pressure– the lowest pressure for a ship near an Atlantic tropical cyclone this year.

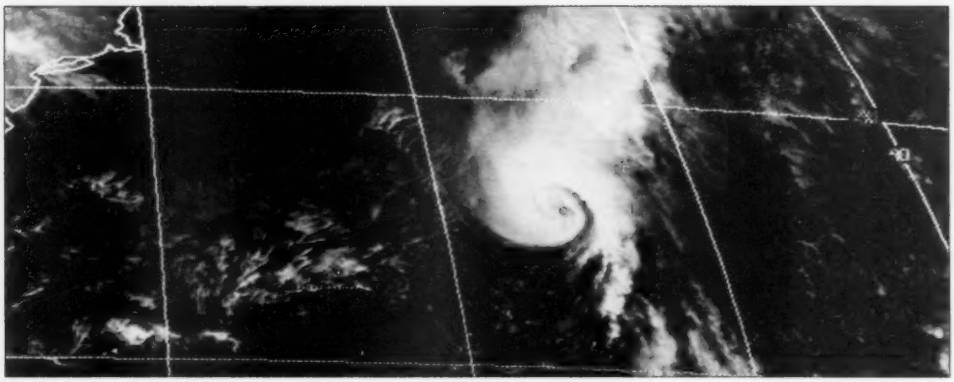
The strong extratropical storm nearly stalled along the Brittany coast of France, pounding the area with winds of about 70 knots.

Hurricane Gert

Gert was spawned by a tropical wave that crossed the west coast of Africa on the 5th of Septem-



A slow movement gave Gert (left) adequate time to intensify over the warm waters of the southwest Gulf of Mexico. Hurricane Gert sports a ragged eye as it nears the coast of Mexico in this visible GOES-7 image on the 20th of September at 1500. Gert dumped large quantities of rain over portions of Central America and even larger amounts in Mexico where 24-hour totals approached 432 millimeters (17 inches). Resultant floods and mudslides appear to be responsible for many deaths. The government of Mexico reported 42 deaths and 2 injuries.



Harvey briefly reaches hurricane strength and a transient eye is seen in this visible image from METEOSAT-3 on the 20th of September at 1800 UTC.

ber. A weak surface Low accompanying the wave passed over Trinidad on the 11th. Over the next couple of days, most of the system moved over the extreme northern part of South America. It emerged over the waters of the southwest Caribbean Sea late on the 13th where the upper-level flow favored development. A tropical depression formed from the system about 90 miles north of Panama around midday on the 14th.

The depression strengthened to a tropical storm by the morning of the 15th but dropped back to depression strength shortly after its center crossed the coast of Nicaragua near Bluefields early that afternoon. The depression then began a nearly 2-day trek over Nicaragua and Honduras. Once over the Gulf of Honduras around midday on the 17th, Gert became a tropical storm again based on a report of 35-knot westerlies from the ***Chiquita Nederland*** and analyses of satellite images. Late on the 17th, Gert moved inland again, near Belize City, Belize.

A ridge of high pressure over the northwest Gulf of Mexico prevented Gert from turning northward. It re-intensified into a tropical storm very early on the 19th, over the Bay of Campeche. Gert strengthened to its maximum intensity of around 85 knots, with a central pressure of 970 millibars measured by reconnaissance aircraft, just before its third landfall.

The eye of Gert crossed the coast of mainland Mexico during the late afternoon on the 20th. A portion of the southern eyewall passed over Tuxpan, where 89-knot winds were reported. Poza Rica (about 25 miles south of Tuxpan) reported winds to 70 knots, and Tampico reported winds to near 50 knots. Gert's weakened over the mountains of Mexico, became a tropical depression early on the 21st. However, the fast-moving circulation remained intact and emerged over the eastern Pacific waters where it was reclassified as Tropical Depression Fourteen-E.

Gert dumped large quantities of rain over portions of Central America and even larger amounts in Mexico, where 24-hour totals approached 432 millimeters (17 inches). Resultant floods and mudslides were responsible for many deaths. Mexico's government reported 42 deaths and 2 injuries. Press reports indicated that there were 21 deaths in Honduras, 8 in Nicaragua, 4 in El Salvador, and 1 in Costa Rica. Some 76 deaths were associated with Gert. Damage totals are incomplete, but at least $166 million in damage occurred in Mexico and Central America.

Hurricane Harvey

Harvey was one of the year's short-lived cyclones, lasting only 72 hours. Nevertheless, because it moved quickly across the central North Atlantic shipping lanes, it yielded the most (eight) ships reporting tropical storm conditions in 1993.

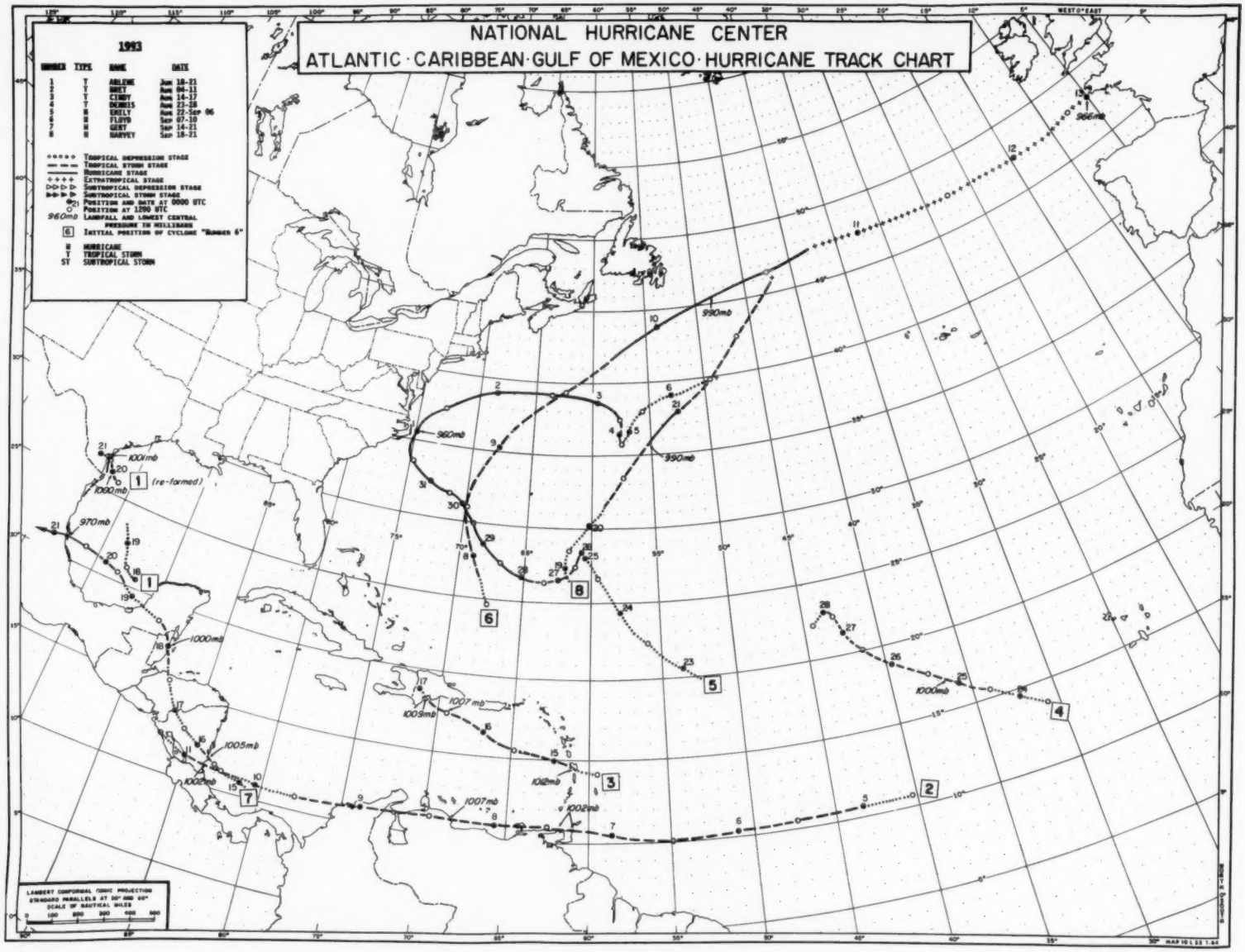
The interaction of a tropical wave and a nearby upper-level low coincided with the system gaining tropical depression status about 350 nautical miles to the south southeast of Bermuda on the 18th of September. A ship, with call sign ELFS reported 37-knot easterly winds that afternoon in a band of heavy thunderstorms about 130 miles from the circulation center. Its wind was probably not completely representative of the depression's interior circulation.

Satellite images showed a partially exposed low-level cloud center until the 20th. Deep convection then developed near the center and the system became Tropical Storm Harvey about 300 miles to the east of Bermuda. About a day later, an eye appeared briefly on satellite pictures, indicating that Harvey was a hurricane for a short period. Harvey weakened quickly upon passing over cooler waters. On the 21st, six ships reported tropical storm force winds before the system became extratropical and was absorbed by a frontal band during the evening hours. The ***American Falcon*** recorded the highest wind at 50 knots.

Tropical Cyclone Winds
(ship encounters and selected other marine observations of at least 34 knots)

Tropical Cyclone	Ship/Platform name or ID	Date Mo/Da	Time UTC	Position LatN	Position LonW	Wind (kt) Dir/Speed[a]	Pressure (mb)
Arlene	**42002**	6/19	0945	25.9	93.6	134/35	1006.3
	7W2	6/19	1103	28.5	92.5	120/45	
	S58	6/19	1139	28.2	90.7	140/40	
	5RO	6/19	1348	28.2	93.8	110/45	
	Davao Trader	6/19	1800	27.1	92.8	E100/45	1011.7
	O1T	6/19	1946	28.1	94.4	E130/40	
	7R8	6/19	2000	28.3	92.0	090/40	
Bret	**Lady Elaine**	8/07	1200	E12.0	61.7	/40	
	Probo Baro	8/09	0500	11.0	75.7	070/38	1002.0
	Probo Baro	8/09	0800	11.3	75.2	070/39	1002.0
	The Hooker	8/09	1800	11.4	80.0	010/40	1009.5
Cindy	None						
Dennis	None						
Emily	**OMI Missouri**	8/26	1100	26.9	60.6	140/64	1012.0
	41002	8/30	0850	32.3	75.2	263/34	1005.5
	C6IK8	8/30	1200	33.7	69.3	150/35	
	Diamond Shoals Light	8/31	2225	35.1	75.3	295/89[b]	980.8[c]
	DGNB	9/01	0000	34.3	75.4	260/38	1008.5
	CHLV2	9/01	0500	36.9	75.7	005/36	1006.6
	44014	9/01	1450	36.6	74.8	338/55	984.0
	44004	9/01	1950	38.5	70.7	328/60	981.5[d]
	Oleander	9/01	1800	36.2	70.1	220/40	1014.5
	Thompson Lykes	9/01	1800	35.2	71.4	230/35	1017.5
	J. Dennis Bonney	9/01	1800	37.0	69.6	220/40	
	BBJJFN	9/03	1200	36.5	58.4	280/47	1005.2
	Northern Enterprise	9/03	1800	35.7	56.7	230/40	1005.2
Floyd	**RYG**	9/09	1500	37.3	59.1	190/34	1016.7
	44141	9/09	1900	42.0	56.1	160/36	1001.9
	44141	9/09	1955	42.0	56.1	200/60	998.0
	44141	9/09	2100	42.0	56.1	/47	1001.3
	Cast Muskox	9/10	1800	47.1	36.1	160/50	994.0
Gert	**3EUU6**	9/15	1200	8.7	84.9	260/35	1010.0
	Chiquita Nederland	9/17	1600	16.0	87.7	280/35	1004.1
	Bremen Senator	9/20	0000	21.7	95.6	010/35	1002.0
	Bremen Senator	9/20	0300	20.7	97.7	330/34	1001.0
Harvey	**ELFS**	9/18	1800	28.5	60.1	090/37	1013.5
	APJ Angad	9/20	1800	35.4	54.8	200/46	1012.5
	Sea Princess	9/21	0000	38.0	44.5	180/36	1016.6
	Saga Ocean	9/21	0000	40.4	52.5	360/36	1003.6
	DSR Europe	9/21	0600	44.7	49.5	310/35	1007.5
	American Falcon	9/21	0600	38.4	47.0	160/50	1004.0
	Arild Maersk	9/21	1200	42.4	42.3	200/46	1008.0
	Star Florida	9/21	1200	40.6	41.3	160/38	1015.0
	Arild Maersk	9/21	1800	42.3	39.7	180/40	1014.0

[a] Non-uniform averaging periods and elevations; highest reported sustained wind speed for each platform
[b] Peak gust 128 knots
[c] 964.5 mb at 2100 UTC
[d] 969.9 mb at 1850 UTC


NATIONAL HURRICANE CENTER
ATLANTIC · CARIBBEAN · GULF OF MEXICO · HURRICANE TRACK CHART
1963
NUMBER TYPE NAME DATE
1 T ARLENE June 16-21
2 T BRET June 24-27
3 T CINDY June 14-17
4 T DENNIS June 23-28
5 H EMILY July 22-Sept 06
6 H FLOYD Sept 07-10
7 H GERT Sept 14-21
8 H HARVEY Sept 18-21
Tropical depression stage
Tropical storm stage
Hurricane stage
Extratropical stage
Subtropical depression stage
Subtropical storm stage
Position and date at 0000 UTC
Position at 1200 UTC
Landfall and lowest central pressure in millibars
Initial position of cyclone "Number 6"
H HURRICANE
T TROPICAL STORM
ST SUBTROPICAL STORM
(re-formed)
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 20° AND 60°
SCALE OF NAUTICAL MILES

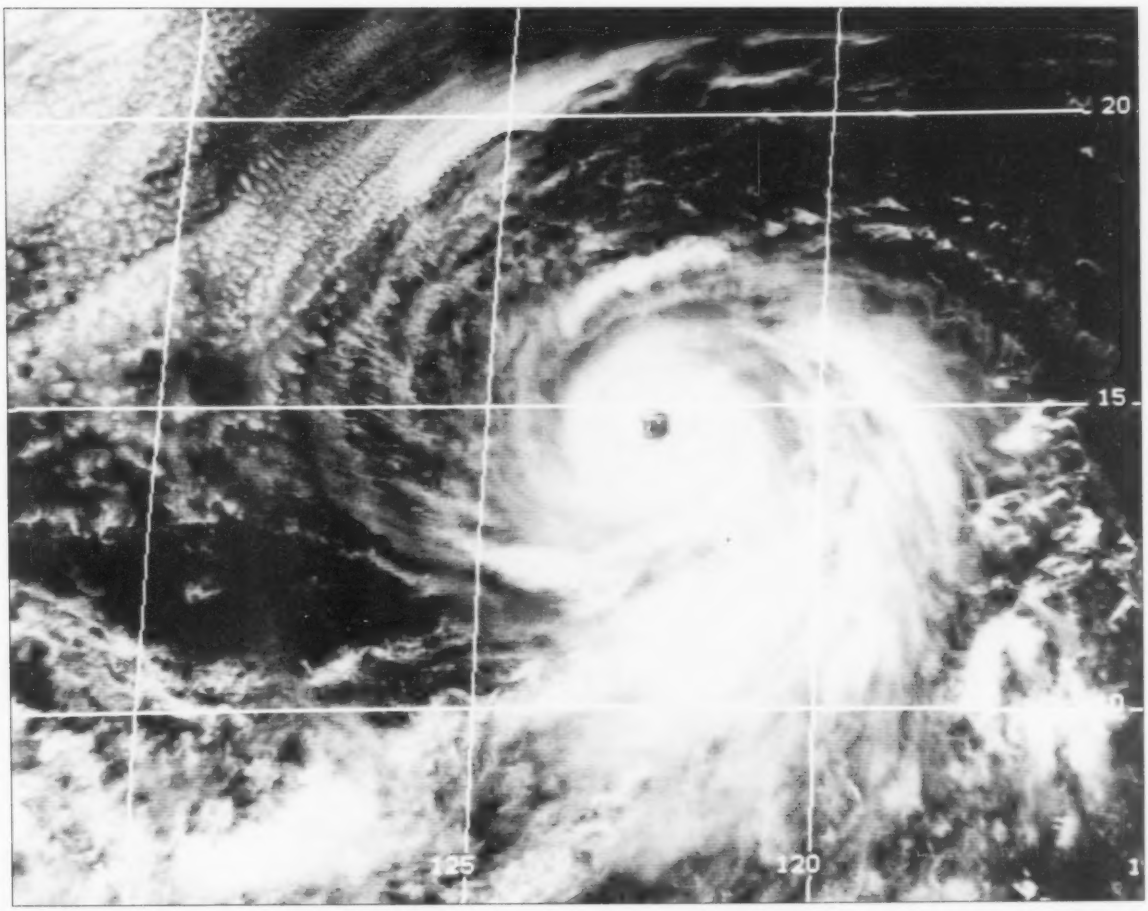
Eastern North Pacific Hurricanes– 1993

Max Mayfield and Lixion Avila
National Hurricane Center

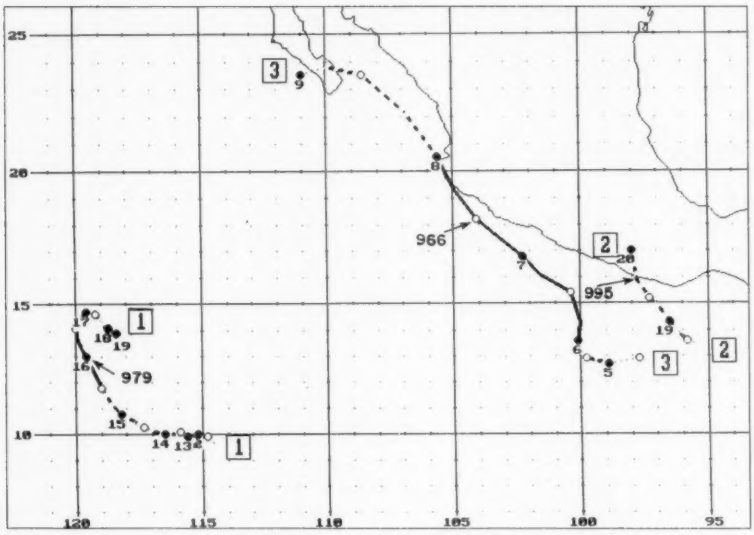
In 1993 some 14 tropical cyclones (tropical storms and hurricanes) including 10 hurricanes roamed the eastern North Pacific; eight were major hurricanes (estimated 1-minute surface wind speeds exceeding 95 knots). This compares to a long term average of 16 tropical cyclones including 9 hurricanes.

The National Hurricane Center (NHC) received nearly 50 ship reports of tropical storm or hurricane conditions this year, which is the largest number since 1988 when NHC assumed responsibility for tropical cyclones in the eastern North Pacific. Even with the use of weather satellites, high quality ship reports are still greatly coveted by forecasters at the NHC. On more than one occasion, the maximum sustained wind speed and the radius of tropical storm force winds carried in the NHC marine advisories were adjusted based on a timely ship report.

As usual, most of the eastern North Pacific



This GOES visible image taken near 1830 on the 11th of August 1993 shows a well-defined eye in Hurricane Fernanda. The hurricane was centered about 850 miles southwest of the southern tip of Baja California and was near its maximum intensity of 125 knots.



tropical cyclones moved on a west through northwest heading and dissipated over cold water without affecting land. Four did make landfall and one closely paralleled the coast. According to news sources, eastern North Pacific tropical cyclones were responsible for 42 deaths: 6 in Beatriz, 34 in Calvin, and 2 in Lidia. Two of the deaths associated with Calvin occurred at sea.

Dora, Eugene, Fernanda, and Greg moved from the eastern North Pacific to west of 140°W and into the Central Pacific hurricane basin.

Three tropical depressions developed which did not intensify into named storms. Two of those depressions affected land. Tropical Depression Three-E brought locally heavy rains to portions of southwest Mexico in late June. Tropical Depression Fourteen-E, which formed from the remnant circulation of Atlantic Hurricane Gert, spread locally heavy rains over portions of central Mexico and near the southern tip of Baja California in mid to late September. In addition, several very rainy areas of disturbed weather affected the west coast of Mexico in the latter part of the season. One of the systems reportedly produced about 635 millimeters (25 inches) of rain with attendant flooding in the Cabo San Lucas area of Baja California.

The following is a summary of tropical storms and hurricanes that had a significant impact on the marine community or affected land.

Tropical Storm Beatriz

Beatriz developed from a westward-moving tropical wave south of the Gulf of Tehuantepec and satellite data and synoptic reports indicated that a tropical depression formed early on the 18th of June about 150 miles south southeast of Huatulco, Mexico. The German ship ***Caroline II*** reported sustained winds of 34 knots some 100 miles southeast of the center at midday on the 18th. Based on this report, the depression was upgraded to Tropical Storm Beatriz. The storm reached its peak with estimated maximum sustained winds of 55 knots and minimum central pressure of 995 millibars near the time of landfall just west of Puerto Escondido, Mexico at 1800 on the 19th. At this time, the Japanese ship ***New York Highway*** reported sustained winds of 54 knots about 45 miles to the southwest of the center. The USCGC ***Mellon*** was then reporting 39-knot winds about 230 miles to the south southeast of the center, indicating a large radius of tropical storm force winds. Beatriz dissipated quickly after interacting with the mountains of southwest Mexico.

Rainfall amounts of between 127.0 to 254.0 millimeters (5 and 10 inches) were reported from observing sites in the state of Oaxaca. Even larger storm total amounts of 392.7 and 304.0 millimeters (15.46 and 11.97 inches) were reported from Salina Cruz and Las Pilas, respectively. News sources associated six deaths in the states of Morelos and Veracruz with storm-related flooding and falling trees.

Hurricane Calvin

Calvin formed south of the Gulf of Tehuantepec when a tropical disturbance reached tropical depression status near midday on July 4th with the system centered about 275 miles southeast of Acapulco. It became Tropical Storm Calvin early on the 5th. Satellite imagery indicated that a banding-type eye had developed, and Calvin became a hurricane later that same day.

Based on ship reports and satellite imagery, the system grew rapidly and late on the 5th, 30-knot surface winds were report-

---

Max Mayfield and Lixion Avila are Hurricane Specialists at the National Hurricane Center in Miami, Florida. Also making significant contributions to this report were Miles Lawrence, Richard Pasch, and Edward Rappaport of the NHC, as well as Alberto H. Unzon of the Servicio Meteorologico Nacional de Mexico.

Eastern North Pacific Hurricanes and Tropical Storms– 1993

No.	Name	Class[a]	Dates[b]	Maximum sustained wind (knots)[c]	Lowest pressure (mb)
1	Adrian	H	6/11-6/19	75	979
2	Beatriz	T	6/18-6/20	55	995
3	Calvin	H	7/4-7/9	95	966
4	Dora	H	7/14-7/21	115	945
5	Eugene	H	7/15-7/25	110	948
6	Fernanda	H	8/9-8/19	125	934
7	Greg	H	8/15-8/28	115	948
8	Hilary	H	8/17-8/27	105	957
9	Irwin	T	8/21-8/22	60	999
10	Jova	H	8/29-9/6	115	948
11	Kenneth	H	9/5-9/18	130	932
12	Lidia	H	9/8-9/14	130	930
13	Max	T	9/30-10/4	40	1000
14	Norma	T	10/2-10/6	45	1000

[a]T:tropical storm, wind speed 34-63 knots.
H:hurricane, wind speed 64 knots or higher.

[b]Dates begin at 0000 UTC and include tropical depression stage.

[c]Wind speed over a one-minute span.

Table and Track Chart Legend

.....	Tropical depression stage
- - - -	Tropical storm stage
———	Hurricane stage
+ + + +	Extratropical stage
•	Position and date at 0000 UTC
0	Position at 1200 UTC
6	Cyclone "Number 6"

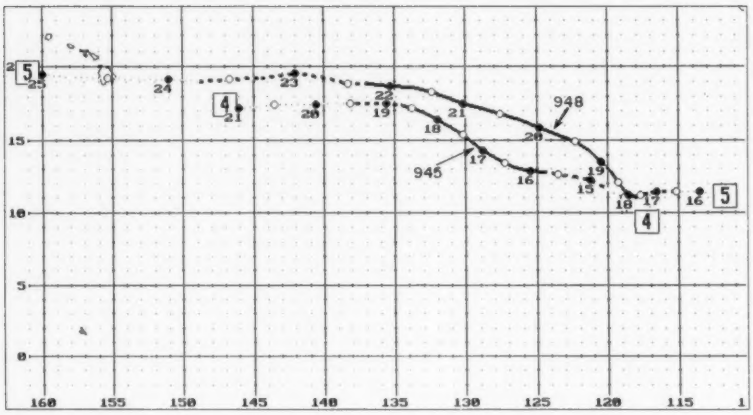
ed nearly 200 miles from the center. Although the center of the cyclone was then a few hundred miles offshore, widespread rains were falling over southern Mexico.

Late on the 5th, Calvin accelerated northward for about 12 hours before turning toward the northwest. These course changes brought the center of Calvin to 90 miles south southwest of Acapulco.

By 1500 on the 6th, Calvin was centered 30 miles to the southwest of the ship ***Pacific Sandpiper***, which reported sustained winds of 85 knots. This report suggested that the intensity estimates on this day from satellite imagery were too low.

The eye became more distinct in satellite imagery and Calvin peaked at 95 knots at about midday on the 7th, centered about 30 miles offshore. Some weakening occurred prior to the center making landfall at 1800, about 40 miles west northwest of Manzanillo. The observers at the National Meteorological Service of Mexico station in Manzanillo recorded a minimum pressure of 986.5 millibars and sustained winds of 73 knots as the center of Calvin passed by on the 7th.

The circulation center



reentered the Pacific at about 0000 on the 8th. Calvin's interaction with the mountainous terrain weakened it to a rather poorly organized tropical storm. The broad circulation persisted, however, generating seas in excess of 3.7 meters (12 feet) up to 300 miles south of the center.

The storm continued to weaken and was a tropical depression with just a few clusters of deep convection when the center moved ashore just south of La Paz, Baja California during the afternoon of the 8th. Calvin dissipated about 12 hours later over the colder waters that lie west of the peninsula.

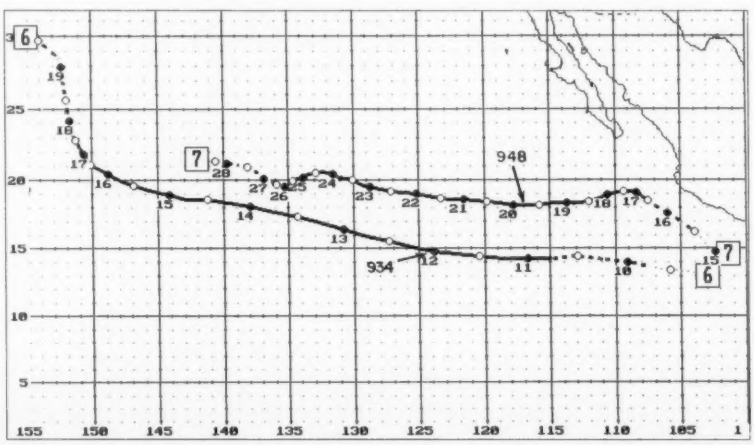
Several ship reports in the vicinity of Calvin were received at the NHC. In addition to its pressure and wind data, the ***Pacific Sandpiper*** reported wave heights reaching a maximum of 13.4 meters (44 feet) at 1500 on July 6th. The Pacific waters near the west coast of Mexico run rather deep (with the exception of the Gulf of California). While this bathymetry likely limits the potential height of storm surges, it is conducive to large and potentially destructive waves. Reports of 4.0- to 4.9-meter (13 to 16 foot) water heights near the shore were received by NHC and likely represent a superposition of storm surge and waves. Waves 4.6 meters (15 feet) high reportedly rolled through some Acapulco streets. Rainfall totals of between 127.0 and 254.0 millimeters (5 and 10 inches) occurred in several states. Las Pilas, in Oaxaca, had the largest reported accumulation, 415.0 millimeters (16.34 inches).

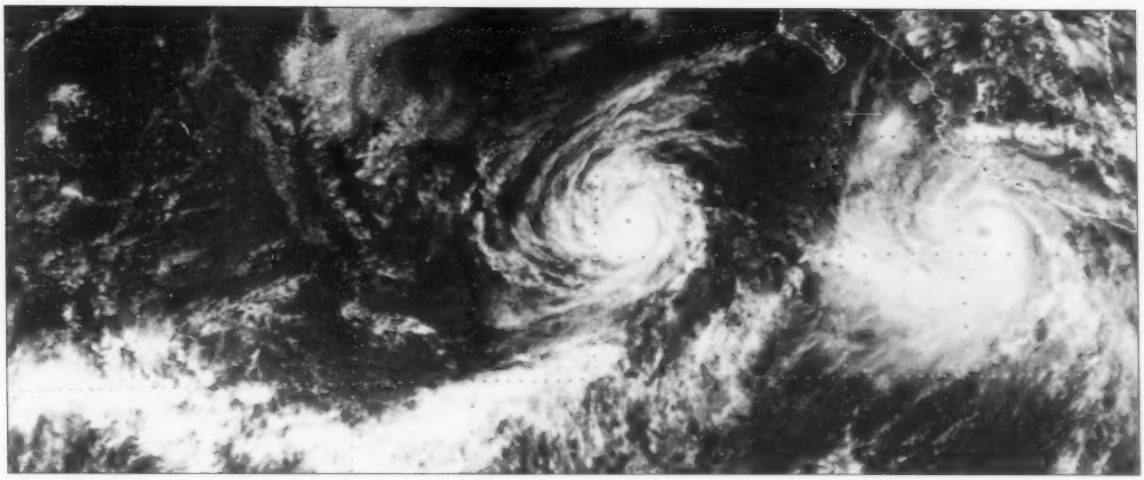
Although there have been more than 150 July tropical cyclones in the eastern North Pacific since 1949, Calvin was just the second July hurricane during that period to make landfall on the west coast of Mexico. (The other, Hurricane Eugene in 1987, came ashore at almost the same spot as Calvin.) Most July tropical cyclones are steered out to sea by a large area of high pressure centered, on average, over southwestern Texas. In early July 1993, however, a large-scale trough dominated the region extending northward from northern Mexico. That trough was also associated with the rains that caused record flooding in the central United States.

Reports from *The Miami Herald* and the *West Hawaii Today* indicated that Calvin took the lives of 34 people (this count is believed to include some "indirect" deaths; e.g., an unknown number from traffic accidents on wet roads). Most of the fatalities were related to flooding that occurred prior to Calvin making landfall.

At least two fatalities occurred offshore. According to the *West Hawaii Today*, the Mexican Coast Guard found the bodies of two people aboard the ***Sultan***, a 16.2-meter (53 foot) trimaran, that was overturned about 300 miles southwest of Acapulco.

A state of emergency was declared in at least 10 states in Mexico. The Mexican Defense Department said that 42,063 people were evacuated in 11 states. At least 1,600 people were made homeless. *El Herald* of Mexico City reported that preliminary damage estimates were at least 100 million ("new") pesos (about $32 million). Much of the damage was due to flooding from rainfall over several states. In addition, news photographs and reports indicated damage to shoreline structures and boats from Acapulco northwestward through Manzanillo, appar-





This GOES visible picture taken near 2200 UTC on the 10th of September shows Hurricane Kenneth centered about 650 nautical miles southwest of the southern tip of Baja California and Hurricane Lidia centered about 175 nautical miles south of Manzanillo, Mexico. Both hurricanes were near their maximum intensity of 130 knots.

ently caused by a combination of wind, storm surge and ocean waves.

Rough seas near Lazaro Cardenas reportedly caused the leakage of all 4,000 tons of sulfuric acid aboard the previously beached cargo tanker ***Betula***.

A cautionary statement about potentially dangerous waves along the coast was briefly carried in the NHC Public Advisories on Calvin, as it had been during Hurricane Beatriz at the request of the National Meteorological Service of Mexico. The threat of floods and mud slides from heavy rain was also indicated in NHC statements.

Hurricane Hilary

A tropical depression which formed south of the Gulf of Tehuantepec on August 17th became Tropical Storm Hilary on the 18th, some 120 miles south of Huatulco. Hilary paralleled the southwest coast of Mexico through the 21st, bringing the center some 200 miles to the west of Manzanillo. Hilary became a hurricane on the 19th, and the first hint of an eye on satellite pictures occurred early the next day. A ship report from the ***Zim America*** indicated that tropical storm force winds extended outward as much as about 150 miles.

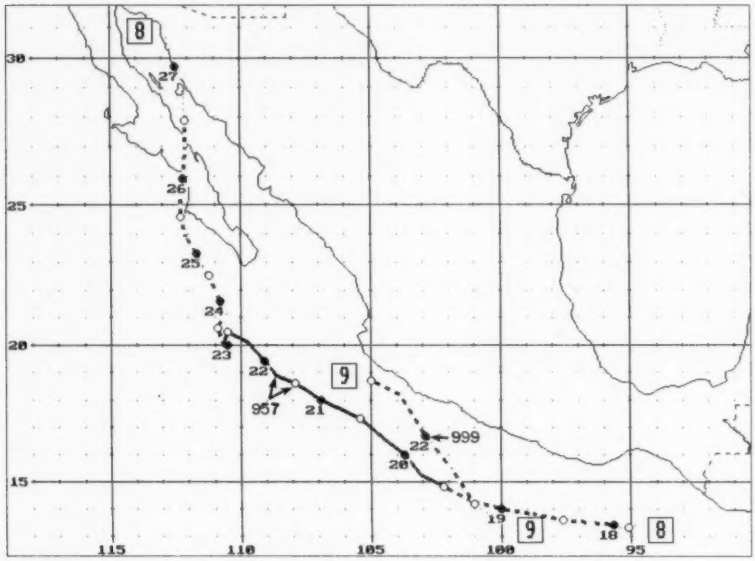
Hilary reached its estimated peak intensity of 105 knots early on the 21st and nearly stalled before turning westward on the 22nd. By the 23rd, it slowly executed a small counterclockwise loop about 150 miles south of the southern tip of Baja California, probably a result of an interaction with Tropical Storm Irwin, initially located several hundred miles to the southeast of Hilary. Hilary weakened as Irwin moved rapidly up the coastline. Irwin's center passed within 250 miles east of the center of Hilary.

Hilary resumed a track toward the northwest on the 24th,

Monthly Summary of 1993 East Pacific Tropical Cyclones

	May	Jun	Jul	Aug	Sep	Oct	Nov	Total
Tropical Depressions	0	1	0	0	1	1	0	3
Tropical Storms	0	1	0	1	1	1	0	4
Hurricanes	0	1	3	4	2	0	0	10
Total	0	3	3	5	4	2	0	17

(Tropical cyclones are assigned to the month in which they first became a tropical depression)



but by then, the estimated maximum sustained winds had decreased to 35 knots. Although its center moved into colder water, across the sharp gradient of sea-surface temperatures just west of the southern part of Baja California Sur, the atmosphere apparently became more favorable for strengthening. An upper-level high developed over the tropical cyclone and deep convection redeveloped near the circulation center. Satellite pictures and ship reports indicate that Hilary reintensified. The ship with call sign PGBB measured a pressure of 1004.5 millibars at a position 65 miles northeast of the circulation center at 1200 UTC on August 24th, and the ship with call sign ELFK (fifth call letter and name unknown) observed 45-knot winds 55 miles northeast of the center 6 hours later.

Hilary made landfall over Baja California on the 25th, with estimated maximum wind speeds as high as 55 knots. The storm weakened over land, but some regeneration occurred over the Gulf of California. The system was a depression when it came ashore on the mainland to the west of Hermosillo about midday on the 26th. The residual low-level circulation center dissipated early on the 27th, a little to the east of the northern end of the Gulf of California.

The largest rainfall total along the southwest coast of Mexico reported by the National Meteorological Service of Mexico was 288.3 millimeters (11.35 inches) from Derivadora Jala, Colima. About 101.6 to 152.4 millimeters (4 to 6 inches) of rain were reported from the states of Colima, Michoacan, and Baja California Sur. In addition, nearly 63.5 millimeters (2.5 inches) of rain were reported at several locations in Arizona. There were no casualties or damages reported in association with Hilary.

Tropical Storm Irwin

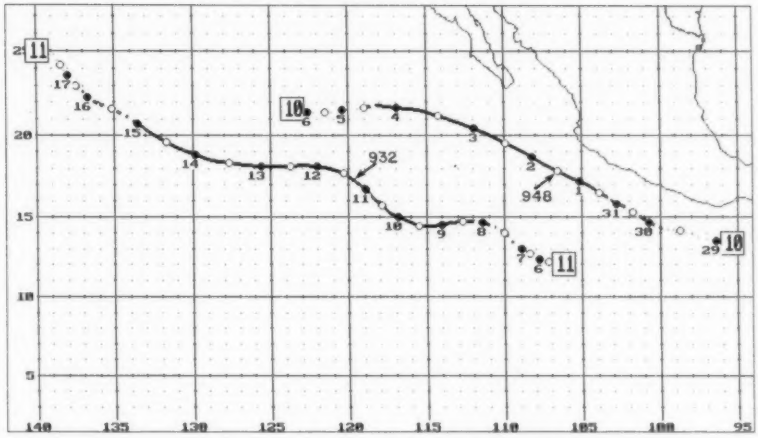
A tropical depression formed early on August 21st south of Acapulco where satellite images indicated an increase in the organization of clouds and thunderstorms associated with a tropical wave. This quickly became Tropical Storm Irwin while moving toward the southwest coast of Mexico. Observations from the ***BT Nestor*** confirmed this strengthening. The ship reported 52-knot winds just east of the developing center at midday on the 21st.

Although surface observations indicated that Irwin was strengthening, its cloud pattern changed little and most of the satellite wind estimates were never higher than 40 knots. However, reports from Manzanillo, Mexico, and surrounding ships, suggest that Irwin's maximum winds may have been 60 knots, with a minimum pressure of 999 millibar near 0000 on August 22nd. Irwin moved parallel to, and near, the coast of Mexico and was absorbed by the much larger circulation of Hurricane Hilary by 1800 UTC on August 22nd.

Manzanillo reported sustained winds of 57 knots and a minimum pressure of 1003.5 millibars at 0830 on the 22nd, when Irwin was about 40 miles to the south. At the same time, winds of 85 knots in the Manzanillo harbor were estimated by a manager of a hotel there. In a telephone conversation with the NHC, the manager commented: "Winds are certainly strong but not as strong as in Hurricane Calvin." Those winds appear to be overestimated in comparison to the official data from the Mexican Weather Service in Manzanillo. Wind estimates from ***CPC Holandia*** a few hours prior to the peak wind report at Manzanillo also appear a little too high. A maximum rainfall of near 177.8 millimeters (7 inches) was recorded at Jala, a dam located in the state of Colima. The NHC received no reports of damage associated with Irwin.

Hurricane Lidia

A tropical wave that crossed the west coast of Africa on



August 24th was likely the precursor to Lidia. As the wave moved over the eastern Pacific south of Central America, from the 4th to the 7th of September, deep convection increased, and the convective clouds gradually consolidated. By 1200 on the 8th, a circular-shaped area of convection appeared 200 to 300 miles south of the Gulf of Tehuantepec, and the "first-light" visible satellite images suggested that a tropical depression had formed with well-defined banding features and a distinct low-cloud circulation.

By 1800 of the 8th, the cyclone was nearly a tropical storm, as evidenced by a 33-knot wind report from the ***Pacasia***. By 0000 on the 9th, the system was a 40-knot tropical storm centered about 270 miles south southwest of Salina Cruz. Very deep convection developed over the central portion of the storm, and upper-level outflow became well established. Lidia became a hurricane early on September 10th.

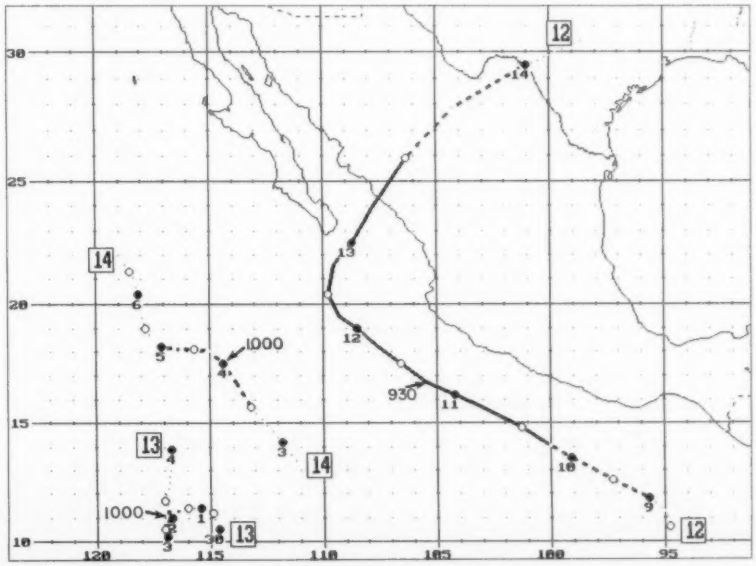
Lidia paralleled the southwest coast of Mexico for the next day and a half while continuing to strengthen. The ***B. T. Alaska*** reported 90-knot winds (the highest winds from a ship report received at the NHC this year), a 989-millibar pressure and a radar fix indicating the eye of Lidia about 12 miles to its south southwest at 0600 on the 10th. Lidia reached peak intensity of 130 knots early on September 11th. The steering flow gradually became more southwesterly, and the hurricane began recurving on the 12th. By 0000 on the 13th, Lidia was headed toward mainland Mexico.

Maximum sustained winds were estimated to be near 85 knots when the hurricane made landfall in the state of Sinaloa, a short distance to the south southwest of Culiacan, around 0800 UTC on September 13th.

Lidia weakened rapidly over the high terrain of Mexico and was reduced to a tropical storm around midday on the 13th and to a depression just after crossing the Texas/Mexico border. The cyclone dissipated over south-central Texas, near Austin, on the 14th and Lidia's remnants merged with a cold front.

No measurements of tropical storm force or stronger winds have been received from Mexico. However, the government of Mexico indicated that winds of "near hurricane force" occurred over the area from near Mazatlan to Culiacan as Lidia was making landfall. Rainfall totals of 101.6 to 203.2 millimeters (4 to 8 inches) were reported from the state of Sinaloa, Mexico.

There were 2 deaths reported in Mexico, one in Sinaloa (near Culiacan) due to electrocution and another in Durango due to the collapse of a dwelling. At least 10,000 persons were "displaced" in Mexico. Structural damage was reportedly extensive in Sinaloa and Durango, and it was reported that 100 houses were destroyed in La Cruz while hundreds of shanty-type homes were said to have been demolished by wind and rain in the Mazatlan area.



Tropical Cyclone Winds
(ship encounters of 34 knots or higher)

Tropical Cyclone	Ship Name	Date Mo/Da	Time UTC	Position LatN	LonW	Wind (kt) Dir/Speed	Pressure (mb)
Beatriz	Caroline II	6/18	1200	12.3	94.8	230/34	1006.8
	New York Highway	6/19	1800	15.5	98.4	270/54	1000.9
	USCGC Mellon	6/19	1800	12.3	96.8	230/39	1010.8
Calvin	Pacific Sandpiper	7/06	0600	16.6	101.3	100/46	1005.9
	Pacific Sandpiper	7/06	1200	16.4	101.2	070/50	998.2
	S. Charleston	7/06	1200	16.3	99.4	120/40	1005.2
	Pacific Sandpiper	7/06	1500	16.3	101.2	080/85	988.4
	Pacific Sandpiper	7/06	1800	16.3	101.3	120/62	994.4
	Melville	7/06	1800	15.5	99.0	180/40	1009.7
	S. Charleston	7/06	1800	16.3	99.3	120/37	1010.0
	Pacific Sandpiper	7/06	2100	16.4	101.4	150/60	997.1
	Pacific Sandpiper	7/07	0000	16.5	101.3	170/47	1002.4
	S. Charleston	7/07	0000	16.0	98.8	130/35	1009.8
	Pacific Sandpiper	7/07	0300	16.3	101.1	130/48	1008.3
Greg	4XGT	8/15	1800	18.9	104.6	120/35	1013.0
	Overseas Joyce	8/16	0000	18.8	104.7	100/40	1007.5
	C6JK	8/16	0000	19.3	105.4	130/34	1008.0
Hilary	Zim America	8/19	1800	17.2	101.6	140/35	1012.0
	BT Nestor	8/20	1200	16.6	104.7	230/50	1004.5
	CPC Holandia	8/20	2000	18.6	104.6	130/40	1007.8
	Iver Katana	8/21	0000	17.3	108.0	300/35	1007.0
	Isuzugawamaru	8/21	1200	19.6	106.0	120/37	1005.5
	Keystoner	8/22	0000	21.1	107.5	120/35	1007.8
	ELFK?	8/24	1800	23.2	110.5	120/45	1007.5
Irwin	BT Nestor	8/21	1200	14.5	100.4	180/52	1004.5
	CPC Holandia	8/21	1600	17.3	101.8	170/35	1009.0
	CPC Holandia	8/21	2000	17.3	101.7	170/64	1007.0
	Koeln Atlantic	8/22	0600	18.0	103.6	200/52	1007.5
Jova	Zim Savanna	8/28	1800	13.7	94.5	150/37	1011.5
	Zim Savanna	8/29	0000	12.7	92.7	130/37	1010.0
	Bahia Manzanillo	9/05	1800	19.7	124.4	020/40	1015.0
Kenneth	SILVIE III	9/06	0900	9.3	106.0	250/35	1008.0
	SILVIE III	9/06	1200	9.3	106.5	230/34	1008.0
	SILVIE III	9/06	1500	9.3	107.1	230/35	1009.0
Lidia	B. T. Alaska	9/10	0000	14.8	100.0	050/34	1003.9
	B. T. Alaska	9/10	0300	14.7	99.8	060/52	1000.8
	B. T. Alaska	9/10	0600	14.6	99.9	090/90	989.0
	B. T. Alaska	9/10	0900	14.7	99.9	140/70	998.0
	Heidelberg Express	9/11	1800	19.3	105.4	110/44	1009.5
	Omi Dynachem	9/12	1400	21.5	108.6	150/50	998.5
	9VUM	9/12	1500	19.7	106.4	160/37	1012.8
	Omi Dynachem	9/12	1700	21.4	108.3	160/50	1001.0
	TSS Carnivale	9/12	1800	22.1	110.4	030/40	1001.6
	Omi Dynachem	9/12	2000	21.1	108.1	180/50	1002.0
	TSS Carnivale	9/12	2100	22.1	109.5	360/47	996.1
	Omi Dynachem	9/12	2300	20.7	107.9	220/42	1005.0
	TSS Carnivale	9/13	0000	22.0	108.5	230/60	987.7
	9VUM	9/13	0000	20.5	109.0	240/34	1008.0
	TSS Carnivale	9/13	0300	21.9	108.3	230/56	1002.5

USNS *Wilkes*

*USNS **Wilkes** is 86.8 meters of activity. The at –sea research sometimes continues around the clock as the vessel traverses the Yellow Sea between Korea and China. Photo courtesy of Nancy Breen, Military Sealift Command, Department of the Navy.*

USNS ***Wilkes***, the Military Sealift Command oceanographic survey ship operated for MSC by Bay Ship Management, Inc., has a lot in common with the Energizer Rabbit. They both keep going and going and going.

The 86.8–meter (285 foot) ship routinely remains at sea for more than 3 weeks at a time with its crew of 40 civilian mariners and up to 26 oceanographers. In support of Naval Oceanographic programs, the ***Wilkes*** has been collecting oceanographic data in the Yellow Sea between Korea and China.

On a survey operation in October and November 1993, the crew of the ***Wilkes*** studied the ocean's conductivity and temperature as a function of depth. The ship made a total of 187 CTD (conductivity, temperature, depth) drops over the side of the ship–a record second only to the one they established in the North Pacific in 1992.

The data collected is extremely valuable to ocean research. CTD drops were not the only over–the–side efforts made during the voyage. Studies of the sea's optical characteristics as well as of bioluminescence were also completed.

Wilkes sailors supported the various research activities by virtually round–the–clock activity as did other departments. The ship's deck department personnel worked an average of 7 hours a day in addition to their normal 8 hours a day watches. The crew would stand their regular 4–hour watch on the bridge, and then work on deck for another 4 hours. This pace continued for the entire operation except when 12 hours of heavy weather made tasks unsafe.

Wilkes operates from the port in Sasebo, Japan and will remain in the western Pacific for the foreseeable future.

–Frederick K. Smallwood

This story originally appeared in the January 1994 issue of SEALIFT.
–ed.

Massachusetts Maritime Academy

Nancy O'Donnell
National Oceanographic Data Center

In its 103 years of service, Massachusetts Maritime Academy, the nation's "oldest continuously operating maritime college," has been marked by changes in name and location but has always held steady in its course to educate and ready mariners for a life on the sea.

The academy sits at the head of Buzzard Bay, Massachusetts flanked on one side by Buttermilk Bay. On the other side windows overlook Cape Cod Canal where young cadets can perhaps see their futures sailing by.

Like many marine academies affected by the declining seagoing industry, MMA rejuvenated existing programs and created new ones so that it could still boast in 1993 of a 100% job placement after graduation. Its meteorology program in partnership with the National Weather Service, the Center for Marine Environmental Protection and Safety Program (CMEPS), along with its Center for Maritime Training (CMT) demonstrates a commitment to mariners, from undergraduates to professionals returning to enhance their knowledge.

With a growing emphasis on the mariner as meteorological forecaster, the Academy revamped its meteorology program so that it is less a classroom science and more of an onboard skill.

The program was revised under the supervision of Captain Jeff Monroe, Director of the Center of Maritime Training. When Monroe saw the need for students to assume greater responsibility for marine observations, he turned to the National Weather Service (NWS) and set up a program that sent student observations directly to NWS. Monroe negotiated for a hookup with NWS offices at Logan Airport in Boston and Portland, Maine. The NWS in turn responded by assigning Vince Zegowitz, program leader for the VOS program, as a mentor to the students. Zegowitz arranged for material and equipment, and soon the students were sending their observations through the GOES satellite. Ninety students, taking three daily observations and forecasts, provided MAREP reports to the NWS at Logan via a computer system linked by modem to the NWS bulletin board. Marty Bonk, the Port Meteorological Officer from Newark, taught students proper observing procedures.

MMA graduate Jane Howard, '93, works as a Marine Operations Assistant for Amoco Transport Company in Texas City, Texas. Howard emphasizes

the value of her weather forecasting duties aboard the school's training vessel: "It was a really beneficial experience. A lot of info I never thought I'd use, I use on this job. We had a working lab and basically we had a program where every few hours we took the weather. It gave the students a chance to see what people in meteorological offices [like NOAA] were looking for. We learned how to judge the weather...sea height, the height of clouds, barometer and we sent it in."

From her desk at Amoco, Howard uses forecasts on a daily basis for routing decisions that protect scores of ocean going vessels as well as tugs and barges.

Today, MMA students supervise several subordinate locations near Old Portland Lightship Station and send regular observations from two vessels including the mv ***Ranger*** out of Buzzards Bay.

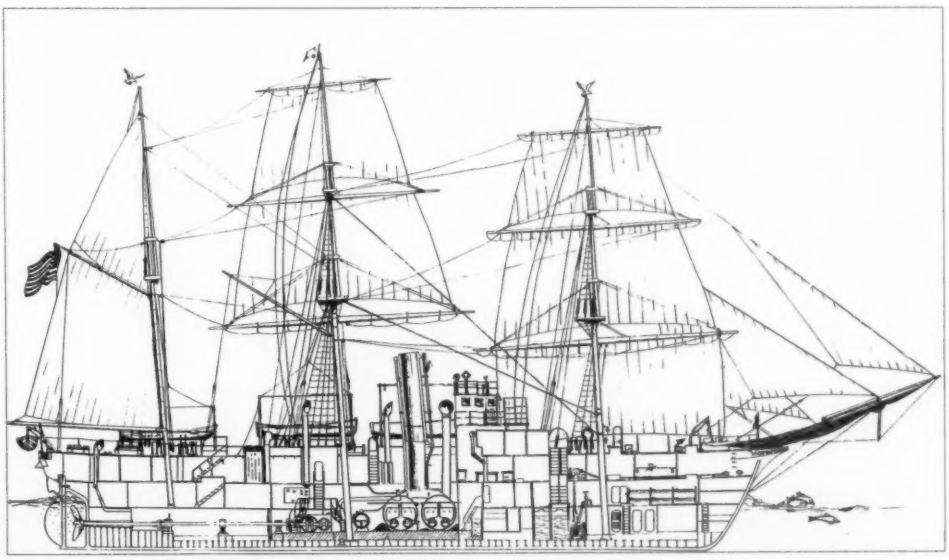
Massachusetts Maritime Academy has worked hard over the years to establish a school of maritime excellence. An Act of Congress in June 1874 authorized the establishment of maritime schools, and by June 1891, the Massachusetts Nautical Training School was established. The first candidates for admission took their entrance exam at the State House in February 1893 and by April of that year, 40 cadets went on board the academy's first vessel, the USS ***Enterprise***.

The Act of 1874 stipulated that the Navy was to provide these state schools with training vessels. The Navy's ***Enterprise***, a full sail and steam powered bark–rigged vessel measuring 185 feet, was soon embarked on its first foreign cruise stopping at Southampton, Lisbon, Funchal, and Las Palmas. In winter it berthed at Rowe's Wharf in Boston where the young cadets attended school in an adjoining yacht club house. The first class numbering 20 graduated in 1895.

The Academy moved to other facilities in the Boston area and eventually to North End Park. It maintained operations throughout the Spanish American war while others temporarily closed their doors. In 1913, its name changed to the Massachusetts Nautical School.

The Academy's part in World War I started with the return of its second training ship, USS ***Ranger***, to the Navy. Thirteen days after war was declared, the first weapon hit of the hostilities against Germany would be directed by a MMA graduate. In late April 1917, Emory Rice, class of 1897, was captain aboard the USS ***Mongolia***, travelling off the coast of England when a radio report cautioned that a German sub had recently sunk a merchant marine ship. As the submarine approached, Rice gave the order to shoot. Lieutenant Ware fired and within seconds, with mathematical accuracy, it hit the conning tower of the German vessel and killed the captain. Former President Theodore Roosevelt in response to the action sent Rice a telegram that read: "I am greatly rejoiced and I congratulate the captain and gunner. Thank Heaven some have at long last begun to hit." Years later Rice would again be commended after he rescued Japanese fishermen in the midst of a fierce typhoon.

In the early 1940s, the Academy moved from Boston to the State Teachers College in Hyannis and at this time the school assumed its present name. As with other maritime academies, MMA accelerated its



The entrance to the Cape Cod Canal is present site of Massachusetts Maritime Academy at Thomas Point (left). The training ship (right) originally called the ***Ranger****, had a name change in 1918 to the* ***Nantucket*** *. It was 53.94 meters (177.4 feet) long at 1,261 tons. The vessel had a wireless telegraph, submarine signal apparatus, and a steam capstan. It was the the Academy's training ship from 1909 to 1942.*

program during World War II and and trained officers in 16 months instead of 24.

In 1949, the first Bachelor of Science degrees were granted and the Academy began to transform with the changing times.

A gunboat is credited with precipitating the Academy's final move from Hyannis to Buzzard Bay. After the war, the Navy's assigned the 328–foot USS ***Charleston*** to MMA. Because Hyannis had no dock, and the cost of dredging and building a dock was prohibitive, Academy Commissioners asked to use the pier at Buzzard Bay, 25 miles away. After a time all facilities were finally transferred to the Bay.

The new campus was appropriate for an area with a long history of maritime enterprise. The nearby town of Aptucxet is the site of the first known commercial enterprise in English–speaking North America and because of the first such contract on record earned the title "Cradle of American Commerce." Before the British invaded the area, the Aptucxet trading post drew the Dutch from New York and the Native Americans of Cape Cod and the Wampanoag Federation to trade and barter goods. The leaders of Plimoth Plantation signed a contract with their British backers in 1626 for a monopoly on trade with the area's Native population if they assumed the debts of the colony. While these Pilgrims are described as "less than avid mariners," they would sail close to the shore, and long before the construction of the Cape Cod Canal, travelled up the nearby Manomet and Scusset rivers if there was possibility of trade

The Canal itself has been a valuable marker to the Academy of the necessity of its programs. It provides students with a laboratory to enhance their skills in one of the nation's busiest sea fares. The Canal, crossing Cape Cod at its base for 15 miles, measures 500 feet wide, 32 feet deep. Competed by the U.S. government in 1914, this deep-draft sea–level waterway connects Buzzard and Cape Cod Bays. As ships travel this major traffic area, they act as a reminder of the possibility of collisions and environmental dangers in modern marine life.

The Center for Marine Environmental Protection and Safety Program (CMEPS) was established in 1992 to prepare all levels of management, mariners and response teams to meet the requirements of the Pollution Act of 1990 (OPA90), the International Maritime Organization (IMO) and state laws governing operations in the ports of the U.S. Instructors are skilled spill response experts, Master Mariners and

environmental scientists. Each course teaches some essential elements of detailed training in spill responses. Prestigious institutions like nearby Woods Hole Oceanographic Institution and the Ocean Science Department of Harvard University support the MMA's efforts.

The Academy has built partnerships with both public and private companies: Clean Harbors, National Response Corporation and Mobil Shipping to name a few. These partner organizations also train students to OSHA certification and may provide them with part-time employment while in school. Investment in technology was another of MMA initiatives. The Oils Spill Response Management and Tanker Liquid Cargo Simulators used in training were developed by NORCONTROL Simulation of Norway and the Marine Group of Connecticut and are the first of their kind in U.S.

The Center for Maritime Training (CMT) Team Training Program introduces new concepts to professionals returning for refresher courses or to study newer technologies. The Visual Ship Simulator recreates a variety of conditions mariners meet in their careers. The Bridge Team Training Program offers masters and watch officers a different look at the decision-making process used in watch conditions during the course of a voyage. It takes mariners through a process of decision making in response to workload and potential threats to the vessel using a team member approach to prevent individual error. One course, Shiphandling for the Master Pilot, emphasizes the handling characteristics of a variety of vessels employing techniques to show how size affects response.

SCHOOLSHIP ship handling training system trains basic skills of the rules-of-the-road and collision avoidance to future mariners with the more sophisticated abilities of deck officer skills, visual piloting and ship handling. Students prepare for the realities of travel: day, dusk, night, the reduced visibility of fog with the distraction of other ships, the helpful clutter of lighted and unlighted buoys and the impact of the surrounding environments sandbars and breakwaters, tanks, bridges and cliffs.

The Fishing/Navigator Simulator enables a student to achieve realistic training in fishing instrument operation, purse seining, pair trawling and single-boat trawling.

The Academy's 120 cadets stand in 6 companies and follow a daily regimental schedule. Students studying for a Merchant Marine Officer's License know they are aiming for excellence.

"The pass rates on 3rd mate and 3rd assistance engineers are the highest in the nation," says director of CMET, Captain Jeff Monroe. "The Naval Officer's Commission is second only to U.S. Naval Academy in Annapolis in its training of top naval leaders. It's a point of pride that in the years of the Academy's history more of its graduates have achieved the rank of Admiral than any other college except the Naval Academy."

Cadets may acquire U.S. Coast Guard licenses as 3rd officers in the Merchant Marine. Additionally students may opt for a Bachelor of Science degree in Marine Transportation,

The Patriot State is an 18,110-ton former cargo and passenger carrier (left). It was turned into a training ship around 1985 by converting cargo holds into classrooms, labs and living quarters for 600 cadets. In class (right) Cadets learn the fundamentals of navigation one of the many basic courses that will allow them to find a place for themselves in the ever changing maritime job market.

Academy Profiles

Captain Jeffery Monroe, Dr. Malcolm MacGregor and Captain Al Wilson

The three instructors profiled stand out for their dedication to make their student's time at the Academy fruitful and enjoyable.

Captain Jeff Monroe, wasn't happy with the turn the study of meteorology had taken. As Associate Professor of Marine Transportation, Monroe saw students learning meteorology in school and then depending on routing services when they began their careers at sea.

"Forecasting was becoming a skill that was starting to disappear," says Monroe. "When weather routing services became popular, people started taking a casual approach to weather. Some ships were mediocre about observations and skeptical about information coming from NOAA. I wanted to get the cycle [of mediocrity] broken, to get future officers to take good obs, to show them how to contribute to the increasing effect of meteorology." Calling it a "public relations problem on the part of NOAA," Monroe starts all over again to make converts of the cadets.

Monroe came to Massachusetts Maritime in 1991 after years aboard ocean vessels, and he quickly became Director of the Center for Maritime Training. A graduate of Maine Maritime Academy, he received his MF in Science Transportation and Management from State University of New York Maritime College in the Bronx. The author of several student texts and contributing author to the Merchant Marine Officer's Handbook, his most recent article was "Shiphandling in Heavy Seas" in the Fall 1993 issue of the Log.

Like Monroe, Dr. Malcolm MacGregor, saw something missing from the conventional marine school curriculum. Environmental studies were a crucial concern to the industry, and at the same time the industry was viewed as declining

Because "there was nothing in place" at the Academy, MacGregor wrote the entire program and instituted the Center for Marine Environmental Protection and Safety Program (CMEPS) in 1992. It is designed to meet the requirements of the Pollution Act for 1990, the International Maritime Organization (IMO) and state laws governing the ports of the U.S.

Students in CMEPS go aboard ships and learn firsthand the issues confronting mariners. The first graduating class of 60 will receive their B.S. in Environmental Protection in 1996 and go on to jobs in federal agencies, engineering firms, the oil industry and local government agencies across the country.

The Academy's focus on practical application is exemplified in MacGregor's program: "I set the program so that it is flexible depending on the market, and I've created sequences like industrial waste management and conservation."

While concerned with the environment, MacGregor stresses the need for incremental changes in policy. "When you put in a law, it's a spike... you interrupt the economic process. Massachusett's stringent hazardous waste laws lost businesses. You want to balance the two, but not at the expense of one over the other. We're training students to see that there is an economic side. It's not just Utopian. You want to make people aware of the environment with each succeeding generation but in a careful, judicious fashion."

MacGregor received a B.S. in Chemistry from Wooster Polytechnic and a P.h.D. in Theoretical Chemistry at the University of Connecticut. He worked as a research associate at the University of Chicago, and joined MMA in 1972

One of Captain Al Wilson's jobs as Placement Director is to make the matches between cadet and ship. Working with the military, Sealand and Presidential Lines and other shipping companies, he usually assigns a student on a random basis. Occasionally, he makes exceptions.

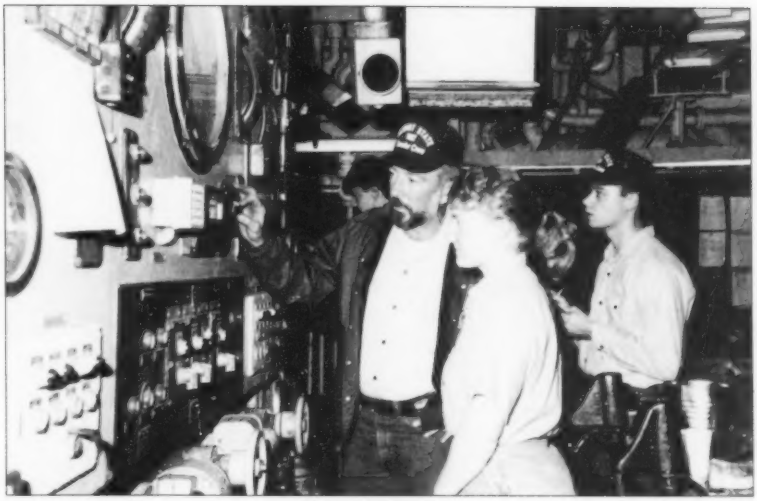
"One cadet, a U.S. citizen, has a family living in Taiwan. I made a call to see who was sailing to ports nearby. Another cadet was born in Korea but left as a kid. He'd love to get back to see what it's like." says Wilson.

Wilson has worked hard to find jobs for his students before and after graduation. Westinghouse, Polaroid, Raytheon, General Electric, Boston Fuel and Gas among others have hired MMA graduates.

Wilson went to sea after graduating from MMA in 1959. He travelled on an old Victory ship around the world, coached high school football and taught social studies for a time. He came to the Academy in 1972. He's worked as Dean of Students, Commandant of Cadets and helped start the school's football program. In 1983 he became the school's Placement Director. He admits his job has gotten harder in the last 20 years. "Look at the numbers. Twenty years ago we had probably 800 ships, in 1981, 600 ships, in 1993–94, 250 ships. However, having said that...we live on oil. We'll need ships, tugs, barges, no matter how much we talk about the declining Merchant Marine."

The Chief Engineer instructs one of MMA's female cadets. Women now comprise 10% of the regiment (right).

Aboard ship cadets are required to perform all of the duties required to run the vessel, including deck maintenance (below).



Marine Engineering, Facilities and Plant Engineering, Marine Safety and Environmental Protection. The Academy's six disciplines include Business Management, Electrical Power, Facilities and Plant Engineering, Marine Fisheries, Marine Transportation and Mechanical Engineering.

A cadet's life in the Academy ultimately revolves around the time at sea. Students take three 2-month training cruises during their 4 college years.

From its first training vessel, U.S.S. ***Enterprise***, the Academy has sought to increase the ability of its school of ships. The ***Enterprise*** was replaced by the USS ***Ranger*** which was equipped with the latest technology for navigation in its day: wireless telegraph outfit, submarine signal apparatus, a steam capstan, steam steering gear.

Today the school operates three vessels. The 20.7-meter (68 foot) vessel ***Edgerton*** is equipped with a complete array of electronic navigational aids, oceanographic equipment, and fishing gear.

The pride of MMA is the t/s ***Patriot State*** described as a "laboratory at sea." The vessel was converted into state-of-the-art classrooms, labs, shops, and simulators between1984-86. First named the SS ***Santa Mercedes***, it was built by Bethlehem Steel at Sparrows Point, Maryland in 1964. Some 166.7-meters (547 feet) long with a speed of 20.5 knots, the ***Patriot State*** hauled cargo and passengers between North and South America for 20 years under commercial Grace Lines, Delta and Prudential before its sale to the the U.S. Maritime Administration. As a training ship with labs and classrooms and quarters for 600 students, it travels to ports in Europe, Africa, North and South America.

At present some of the academy's 745 students may study for the U.S. Coast Guard license as 3rd officers in the Merchant Marine. Others may prepare for careers in marine science, the government and military, engineering, business, environmental protection, law, medicine, management, and education. Whatever their field, students are assured that their initiative, imagination and independence will benefit them individually as graduates of Massachusetts Maritime Academy.

(Special thanks to MMA's historian Maurice Bosse and Director of Public Relations, Christopher Ryan; Captain Harold Lynch of the Boston Marine Society and Eleanor Hammond of the Bourne Historical Society for their assistance).

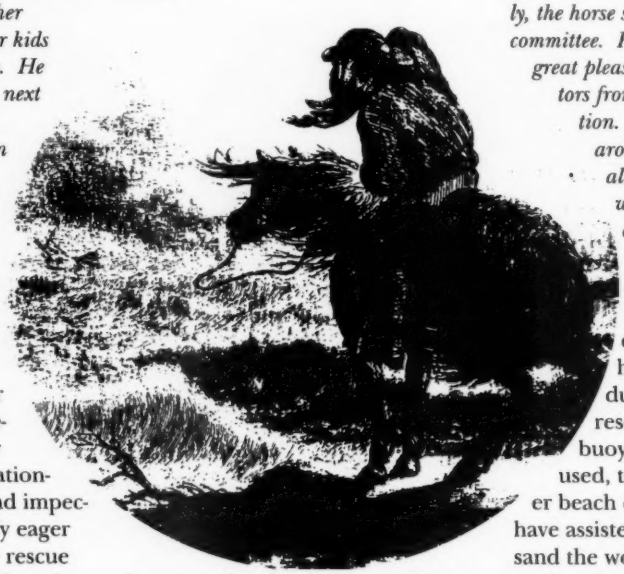
Horses in the Lifesaving Service

Elinor De Wire
Mystic Seaport Museum

"*I saw the horse often during the day. He was usually near people, but few paid any attention to him. One man scratched his head. He liked it and followed the man around hoping for another scratching. Once three or four kids climbed on his back for a ride. He peered in the back door of the next cottage. No one shooed him away, and he ambled off when he felt ready.*"

The gentle beast described by Julian Denton Smith, on his family vacation in 1908 at Point Lookout, Long Island, was a "station horse," also called a "beach horse." These horses roamed their own small parcels of shoreline, munching on poverty grass and visiting with vacationers. They were well fed and impeccably groomed, and usually eager to socialize. But when the rescue horns sounded, they abandoned selfish interests and headed home at a gallop, ready for work with the crews of the U.S. Lifesaving Service.

During its 40 years of operation from 1874 – 1915, the U.S. Lifesaving Service purchased and maintained horses for nearly all its stations. They served alongside the surfmen as trusted team members, for in addition to transportation to and from the stations, there was much



heavy work to be done patrolling the beaches, drilling, and rescuing the shipwrecked.

Though hardworking, the station horse was often a coddled pet whose daily needs were eagerly tended to and whose injury or death was mourned as if he (most were geldings) were human. Hence, he began to believe he actually was:

"A life-saving station horse, like the station crew, seemed delighted with visitors," wrote Smith. "Frequently, the horse seemed to be the welcoming committee. He gave the impression of great pleasure while escorting visitors from the dock up to the station. He seemed to hang around within easy distance all day so as to be ready to walk the visitors back to the dock and see them off."

The primary function of the beach horse was to haul the surfboat carriage from the station house to the launch area during a drill or an actual rescue, or if the breeches buoy or life car were being used, to haul these on a smaller beach cart. He might also have assisted in sinking into the sand the wooden crotch and sand anchor that supported the lifeline. When the rescue ended, it was the station horse who carried survivors and salvaged materials back to the station house.

Another important assignment for some of these horses was

The horses and crew are from Highland U.S. Life-Saving Station at North Truro, Massachusetts in 1913. This photograph was kindly loaned to us from the Collection of William P. Quinn, Orleans, Massachusetts. The Highland Station was one of nine stations built on Cape Cod in the winter of 1872.

the beach patrol. Surfmen maintained a continuous march along their stretches of shore, watching for ships in trouble. They exchanged tokens with neighboring stations or checked in at turn-around points, and they fired Coston flares if they sighted a wreck. The beachpounders, as these patrolmen were called, usually walked their beats, but some chose to ride on horseback. Only the most docile and steadfast horses were used for this duty. They knew their routes well and could plod along surefootedly in even the foulest weather. A few rescued their own riders after the men became frostbitten or lost their way in the fog or a storm. Station horses were trained to return to the station when they heard the rescue horn, but often they instinctively went home for help if their riders became stricken.

Beach working was not easy for the horses, and at some stations it was near impossible to use them. Hooves were shod in broad shoes to help the horses maintain better footing in the soft sand. Their feet had to be carefully inspected each day for pieces of sharp shell that might lodge in the tender frogs of their hooves. Grooming was important too since salt from the sea air could cause sores on their hides.

During intense storms surfmen sometimes covered the horses' faces and led them out on the beach because they became frightened by the tide wash, the roar of wind and the stinging sand.

Beach horses served in lesser roles too such as working in the large vegetable gardens beside the stations and helping the surfmen with fishing. Many lifesavers depended upon the sea for much of their food, as well as a second income. Horses proved invaluable in carting large nets to the beaches and hauling in the catch. They also carried surfmen into the villages to get mail or supplies and to attend church and social events. They were occasionally called upon to perform ceremonial functions -- marching in town parades or bearing the coffins of deceased surfmen.

Cape Cod's Wood End Lifesaving Station dependable steed was named "Jim." In 1902, J.W. Dalton, a surveyor of the Cape Cod stations that year, writes this of Jim:

"He was raised on Cape Cod and has been connected with the station for one year...Jim is an intelligent animal and has upon more than one occasion been of valuable service to the crew by hauling apparatus to scenes of disaster. Jim knows when bad weather prevails and is ever ready to do his share in the work of saving life and property."

A Visit to the Saugerties Lighthouse

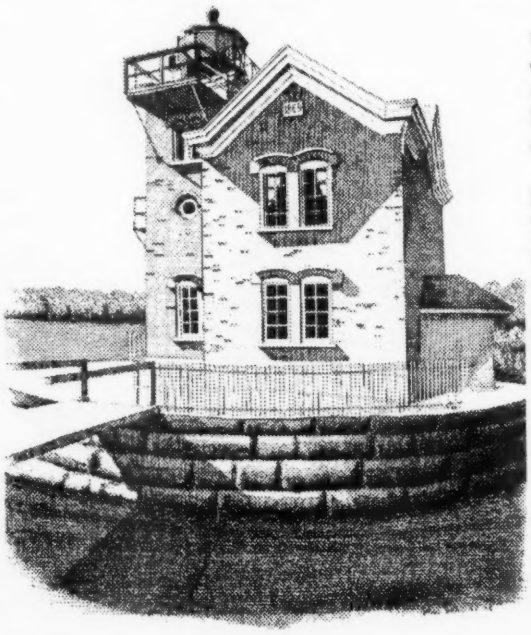
Elinor De Wire
Mystic Seaport Museum

The wind blows briskly out of the southeast as I follow the wet, sandy trail to the old sentinel at Saugerties, New York. Sea oats wave and water bubbles up around the soles of my sneakers, reminding me that the Hudson River is still a tidal estuary here, some 100 miles north of the sea.

There's seldom a day when the wind doesn't buffet the narrow point where the lighthouse sits perched on its round stone pier. Curator Steve Thomas has grown accustomed to the high-pitched squeals coming through the cracks in the walls, the muffled thump of the bell rope against the house, and the rattle of window panes.

At least once a day, he goes up to the lantern gallery to untangle *Old Glory*. Rarely does he hang his wash outside, for the wind would spirit it away, the same way it steals his cap when he escorts me up to the gallery high above the river.

"I'm not a lighthouse keeper in the traditional sense," says Thomas. Yet his life isn't really much different from the keepers who lived here in the 1940s. Though the modern beacon in the lantern runs automatically, and the extra bedrooms upstairs hold displays and overnight accommodations, Thomas still keeps the place in good order. I suspect he's more "keeper" than he thinks.



There's no TV, but a radio quietly plays as we enter the chilly kitchen. Thomas says heat is a luxury. Electricity is meager too – supplied by a small generator.

"I can't keep ice cream in this fridge," he laughs. "Not enough power. Of course, I could store it outside in winter, but it's always hot weather when I want it most!"

He's alert for trouble on the river, though it comes less often than in the past and usually involves recreational boaters rather than commercial vessels.

In summer when the lighthouse opens to the public, Thomas shows visitors around the restored station and enthusiastically recalls the days when sloops, barge tows, ferries, steamboats, and little periaugers passed the lighthouse. In those days there was no electricity, no plumbing and no telephones.

The earliest Saugerties lightkeepers were, like their forebears, river valley folk who loved the water and earned their livelihood from it. Some fished or cut ice;

This solar-powered beacon was installed in the lantern in 1990. Photo by author. The beautiful sketch of Saugerties Light was done by Paul Bradley Jr.

others ran ferries or lightered cargo. They knew every twist and turn, shoal and sandbar of this deep and vital waterway; some even boasted the ability to pilot it blindfolded. As commerce increased on the Hudson River in the early 19th century, lights were needed to guide those less familiar with the 140 mile navigable northward reach into Appalachia. The opening of the Erie Canal in 1825 and the Delaware and Hudson Canal in 1828 made the river a critical link between the rich importers and manufacturers of New York and the burgeoning agricultural communities of the midwest.

Saugerties Lighthouse was the first sentinel established on the Hudson River. In the early 1830s Congress appropriated $5000 for its construction on the north bank of the mouth of Esopus Creek. By 1835 the station was operating. A stone crib served as the foundation for a square house with a lantern on its roof, 12.8 meters (42 feet) above water. Five whale oil lamps, fitted with parabolic reflectors, produced enough light to guide vessels into or past Ulster, as the town of Saugerties was then called.

Abraham Persons, the light's first keeper, served only 2 years before being dismissed. The government discovered that he lived several miles from the lighthouse and had hired someone to tend the light for him. This sort of subcontract was strictly forbidden by the Lighthouse Service. Persons' replacement, George Keys, was reminded to reside on site and to tend the beacon himself.

With the decline of whaling in the 1850s, the lamps were switched to mineral oil. A short time later the station got its first prism lens, a sixth-order Fresnel made in France and fitted with hollow-wicked Argand lamps. Thomas says Saugerties' lightkeepers spent much of their time cleaning and polishing the prisms and brass of the lens.

Saugerties Light was rebuilt in 1867 on a larger stone pier next to the original beacon. The Fresnel lens was moved to the new lighthouse, and for a few years, the two sentinels sat side-by-side– one dark, the other lighted. The older structure was sold and dismantled in 1872.

The second and present Saugerties Light saw 85 years of continuous service before it was automated in 1954 and its keepers removed. Twenty-two keepers, two of them women, had served at the station since 1835. But with no one to maintain it, the lighthouse rapidly deteriorated into a fire hazard. The Coast Guard removed the lens, set up a post beacon to replace it, and announced plans to demolish the historic lighthouse.

Local residents, the retired Saugerties keeper Chester Glunt and his wife Ruth Reynolds Glunt, a local historian and author, mounted a campaign to save their cherished sentinel. For 20 years, the lighthouse languished while the Coast Guard and the public debated options.

In 1976 the Saugerties Arts Council managed to transfer the property into state hands. The Saugerties Lighthouse Conservancy then formed and acquired the lighthouse from the state in 1987. The group has labored to restore Saugerties Light, preserve its history, and make it accessible to the public.

Steve Thomas did much of the carpentry work on the interior, but he's quick to give credit to a long list of other talented contributors. "It was practically a shell. We've truly rebuilt the place," he says.

The beacon was returned to the lantern in 1990, though it is a modern, solar-powered, aero-marine type that doesn't quite match the old-time ambience of the station. But the 1909 fogbell does. As I stand on the gallery looking downriver, Steve Thomas indulges my request to hear the fogbell's lilting bong.

A worn spot hollows the bell lip where the striker has pounded year after year. The bong is low and mellifluous and quickly snatched up by the wind, but its hum lingers a few seconds.

With a wide grin, Thomas asks: "Wanna hear it again?"

For information on visits and Bread & Breakfast accommodations, contact the Saugerties Lighthouse Conservancy, P.O. Box 654, Saugerties, New York 12477, (914) 246-9170.

VOS and the Role of PMOs

Martin S. Baron
National Weather Service

The Voluntary Observing Ships (VOS), an international program under World Meteorological Organization auspices, recruits ships for collecting and transmitting meteorological and oceanographic observations. The scheme dates back to 1853 when Matthew F. Maury, director of the U. S. Navy Hydrographic office, organized a meeting in Brussels where 10 maritime nations could discuss data collection from the oceans.

The WMO VOS program is part of the Global Observing System (GOS) of the World Weather Watch (WWW). Four marine components encompass the WWW GOS: (1) Mobile Ships – 7400 ships from 60 nations, (2) Drifting Buoys – about 650 worldwide, (3) Moored Buoys – 170 worldwide mainly in coastal zones, and (4) Ocean Weather Stations – 3 worldwide.

Port Meteorological Officers (PMOs) support observing programs aboard VOS vessels and are responsible for the total program. The VOS program could not exist without PMO support. As part of their duties, PMOs visit ships to recruit, supply and train observers as well as to provide and calibrate instrumentation. An important part of ship visitation is the PMO's review of completed observation sheets to ensure data quality and correct coding.

Worldwide Problems in Weather Reporting

The basic weather reporting schedule for Voluntary Observing Ships worldwide is four times daily – at 0000, 0600, 1200, and 1800 UTC time. These are the "main synoptic" times, when numerical weather prediction models are initialized with data. The United States and Canada also have an important 3-hourly weather reporting schedule from coastal waters out 200 miles from shore, and from anywhere on the Great Lakes. The coastal zones mark the transition from land to marine weather and can have very changeable conditions, including unique diurnal weather fluctuations. Whenever possible, please transmit weather reports from United States and Canadian coastal waters at 0000, 0300, 0600, 0900, 1200, 1500, 1800, and 2100 UTC.

Coastal zones are not the only areas with data shortages. From the North Atlantic and North Pacific oceans, more observations are needed at 0600 and 1200 UTC. These are late night/early morning reporting times. From May through November, the Northern Hemisphere hurricane season, reports from the tropics and the easterly trade wind belt (roughly 5°–35° N) are in short supply. Southern Hemisphere reports (South Atlantic, Indian and South Pacific Oceans) are also in infrequent as well as data from the Arctic Ocean.

Ship weather reports from the Southern Hemisphere are arriving at National Meteorological Centers later than Northern Hemisphere reports. Peak arrival times for North Atlantic, North Pacific, and Mediterranean Sea reports are around H + 30 (30 minutes after report time). For the South Atlantic, Pacific and Indian Oceans, peak arrivals are H + 45 or later. For all areas, peak arrival times at night are later. The cause of this disparity is unknown. Communications difficulties can be reported to your PMO.

Marine Surface Observations– Summary of Worldwide Problems

(1) Data shortage from coastal waters out 200 miles.
(2) More reports needed at 0600 and 1200 from North Atlantic and North Pacific (late night, early morning reports).
(3) During Northern Hemisphere hurricane season (May through November), more reports needed from the tropics and easterly trade wind belt (5–35° N).
(4) A widespread shortage of data from the Southern Hemisphere and from the Arctic Ocean.
(5) Late arrival of Southern Hemisphere reports. Average H + 45 to H + 60, VS H + 30 to H + 45 for Northern Hemisphere reports.
(6) Peak arrival times at night from all areas are later than requested time.
(7) Air temperature readings not taken from windward side of ship.
(8) Sea surface temperature sensors not calibrated often enough.
(9) Beaufort scale wind speed estimates which fail to take into account the dampening of the sea surface due to rain and surface currents.
(10) Beaufort scale wind speed estimates which fail to take into account the lag period between the wind speed increasing/decreasing and the sea wave height rising/falling.
(11) Poor sighting of anemometer.
(12) Failure to calibrate anemometer once every six months.
(13) Confusing sea from swell, especially when the local wind direction happens to be with the incoming swell.
(14) Coding mistakes or omissions, especially in the first five groups of the weather message (BBXX D...D YYGGi_w 99$L_aL_aL_a$ Q$c$$L_oL_oL_oL_o$).
(15) Uninterested vessels (not wanting to participate in the VOS Program) comprise over 20% of PMO ship visits. These vessels are a large potential data source.

Tips for Accurate Observing

1. When recording air temperature, always take your reading on the windward side of the ship. Your thermometer should be exposed in air fresh from the sea which has not passed over the ship. Sling psychrometers are considered superior to fixed thermometers because of their mobility. Intake or Hull contact sensors for sea surface temperature measurements should be calibrated regularly, every time your vessel is serviced. The accuracy requirement for air and sea temperature is .1°C.

2. When using the Beaufort Scale to determine wind speed, remember that rain, surface and tidal currents will damp down the sea waves. In these situations, wind speed may be higher than indicated by sea state. There is also a lag time between increasing/decreasing wind and rising/falling sea wave height.

3. An anemometer must be sighted so that the ships superstructure does not interfere with air motion near the instrument. The anemometer must be calibrated once every 6 months. The accuracy requirement for wind speed is to the nearest knot, and for wind direction to the nearest 5°.

4. Sea can sometimes be confused with swell, especially when the local wind direction happens to be with the incoming swell. Swell will always have a longer period than sea and will be more regular and uniform.

Reporting

The two main methods of transmitting ship weather reports are (1) through INMARSAT Coast Earth Stations using NWS dial code 41, and (2) through U.S. Coast Guard shore radio stations using Simplex Teletype Over Radio (SITOR) or plain language (recite the coded message using radiotelephone).

The Coast Guard discontinued medium frequency Morse Code (CW) operations July 31, 1993. A third method, through commercially operated shore radio stations (using SITOR or CW), is available as a back-up. Please contact any PMO or see NWS Observing Handbook No. 1, Chapter 4, "Transmitting The Observation To The National Weather Service" for more details. PMO addresses and phone numbers are listed on the inside back cover of this publication.

New Recruits
January–March 1994

During the 3-month period ending March 31, 1994, PMOs recruited 52 vessels as weather observers/reporters in the National Weather Service (NWS) Voluntary Observing Ship (VOS) Program. Thank you for joining the program.

NATIONAL WEATHER SERVICE VOLUNTARY OBSERVING SHIP PROGRAM
NEW RECRUITS FROM 01-JAN-94 TO 31-MAR-94

NAME OF SHIP	CALL	AGENT NAME	RECRUITING PMO
AFFINITY	9VBW	WALLEM SHIP MANAGEMENT LTD	MIAMI, FL
ARKTIS LIGHT	OZBL2	ELITE SHIPPING	MIAMI, FL
ATLANTIC HURON	C6JJ2		BALTIMORE, MD
ATTICOS	3FVD2	TRANSMARINE SHIPPING AGCYS LTD	NEWARK, NJ
BLACK SHEEP	WTKP	MAC GIBSON	MIAMI, FL
CAPE HENRY	KMJH	INTEROCEAN MANAGEMENT CORP	SAN FRANCISCO, CA
CAPE HUDSON	KMJN	MILITARY SEALIFT COMMAND	NORFOLK, VA
CAPE WASHINGTON	WRGH	AMERICAN OVERSEAS MARINE CORP	BALTIMORE, MD
CAPE WRATH	WRGJ	AMERICAN OVERSEAS MARINE CORP	BALTIMORE, MD
CHASTINE MAERSK	OWNJ2	MAERSK INC	NEWARK, NJ
CHC NO.1	3FSL2	INTERNATIONAL SHIPPING CO INC	SEATTLE, WA
CONDOLEEZZA RICE	C6OK	J.E. ASPEN SHIPPING CO	BALTIMORE, MD
CROWN DYNASTY	3SJX3	FLORIDA TRANSPORTATION SERVICES	MIAMI, FL
CROWN JEWEL	3EPW9	FLORIDA TRANSPORTATION SERVICES	MIAMI, FL
DIRECT EAGLE	C6BJ9	AUSTRALIAN-NEW ZEALAND DIRECT LINE	LOS ANGELES, CA
DR JUAN B. ALBERDI	3EVH4	STRACHAN SHIPPING CO	MIAMI, FL
ECUADOR	9HEL3	ASTRAL INTL	NEWARK, NJ
EDELWEISS	VRUM3	INTERNATIONAL SHIPPING CO	SEATTLE, WA
ELSO	ELQA9	CLEARWATER HOUSE	NEW YORK CITY, NY
FARALLON ISLAND	FARIS	BILL SYDEMAN - PRBO	SAN FRANCISCO, CA
FASCINATION	3EWK9	CARNIVAL CRUISE LINE	MIAMI, FL
FREDERICKSBURG	KNJN5	KEYSTONE SHIPPING CO	HOUSTON, TX
GOLDEN ALPHA	3EQW9	MERIT STEAMSHIP AGENCY	SEATTLE, WA
GOLDEN GATE BRID.	8JGM	K LINE AMERICA INC	SEATTLE, WA
GOPHER STATE	WCJV	MILITARY SEALIFT COMMAND	NORFOLK, VA
HANJIN MARSEILLES	3FCU3	HANJIN SHIPPING CO	SAN FRANCISCO, CA
HOLIDAY	C6KM	CARNIVAL CRUISE LINE	MIAMI, FL
J. EMMA	3EEU6	COMPASS MARINE (USA)	SEATTLE, WA
M/V BALIKESIR	TCKG	D.B.DENIZ NAKLIYATI. T.A.S.	NEW YORK CITY, NY
MAERSK SANTIAGO	DGHL	UNIVERSAL MARITIME SERVICE CO	MIAMI, FL
MSC GULIA	SYBG	CONTAINERSHIP AGENCY INC	MIAMI, FL
NEW NOBLE	DZHB	HACHMARA STEAMSHIP CO	SAN FRANCISCO, CA
NOAA SHIP WORTHY	WTEI	NOAA-PACIFIC MARINE CENTER	NORFOLK, VA
NOVA TERRA	C6IZ7	MARINE AGENCY OF TAMPA	MIAMI, FL
NUEVO LEON	XCKX	OCEANS INTERNATIONAL	HOUSTON, TX
PACIFIC EMERALD	3ETF4	INTERNATIONAL SHIPPING CO INC	SEATTLE, WA
REGAL PRINCESS	ELGH6	PRINCESS CRUISES	MIAMI, FL
SAUDI QASSIM	HZZG	NSCSA AMERICA INC	NEWARK, NJ
SEA BELLS	ELCN7	COMPASS MARINE (USA)	SEATTLE, WA
SEA PRINCESS	KRCP	INTERNATIONAL SHIP MANAGEMENT	NEW ORLEANS, LA
USCGC SENECA	WMC906	NMFK	MIAMI, FL
USCGC SENECA	WMEC 906		NEW YORK CITY, NY
USCGC STEADFAST	WMEC 23	NSFT	BALTIMORE, MD
USNS COMET	NJZP	AMERICAN PRESIDENT LINES	SAN FRANCISCO, CA
USNS INDOMITABLE	NKVY	MMAND	NORFOLK, VA
USNS METEOR	NBIJ	AMERICAN PRESIDENT LINES	SAN FRANCISCO, CA
USNS SAN DIEGO	NNCD	MILITARY SEALIFT COMMAND	NORFOLK, VA
USNS WATERS	NWAA	MILITARY SEALIFT COMMAND	NORFOLK, VA
WESTERDAM	C6HE2	HOLLAND AMERICA LINE	MIAMI, FL

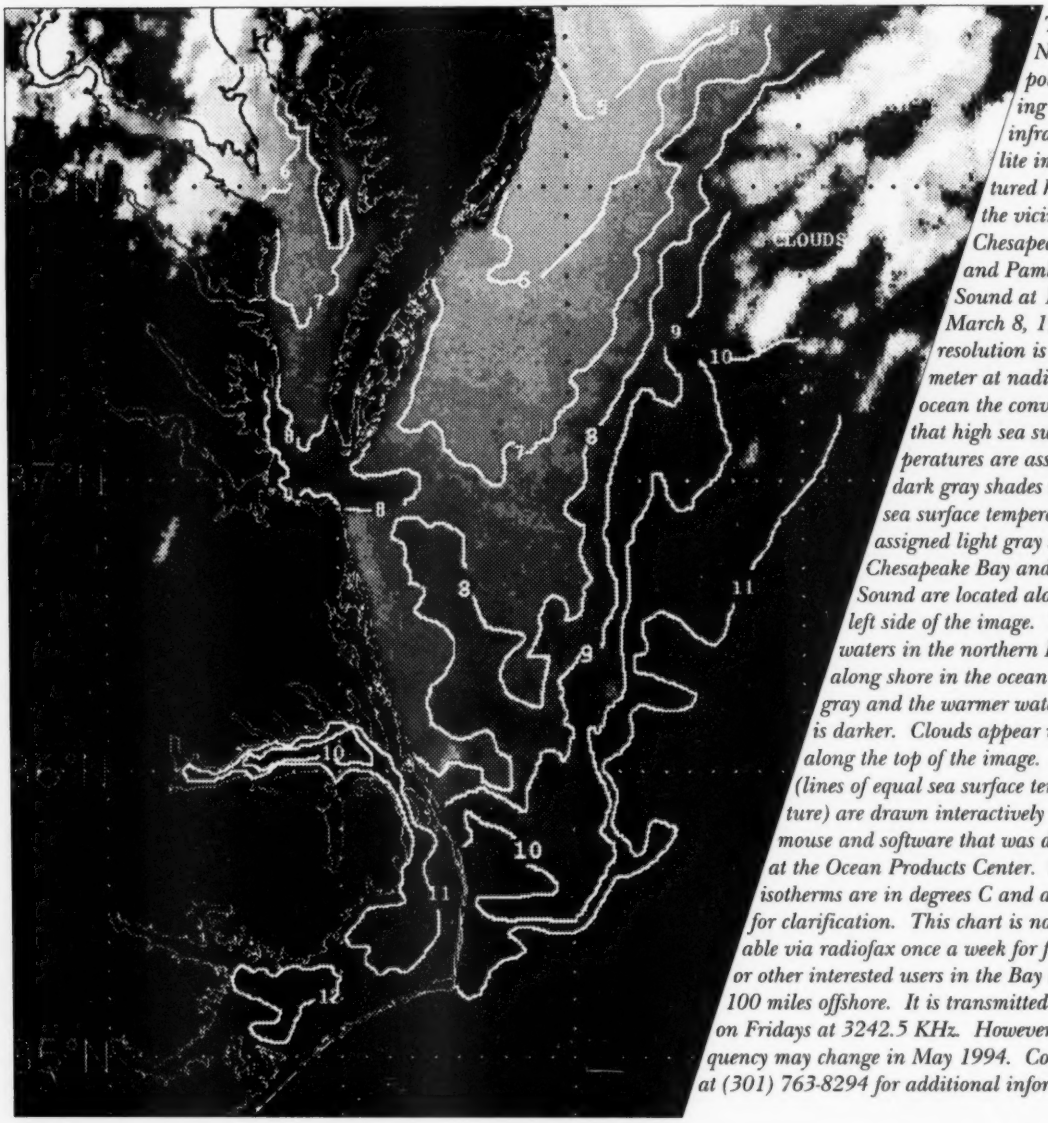
Using a 55mm Lens

Michael Halminski
Photographer

Ocracoke Lighthouse was built in 1823 on Ocracoke Island which is part of North Carolina's Outer Banks. The photo of the 23–meter (76 foot) structure was taken with a 55mm lens.

NOAA Polar Orbiting Satellite

Jenifer Clark
NESDIS



The NOAA polar orbiting thermal infrared satellite image captured here is in the vicinity of the Chesapeake Bay and Pamlico Sound at 1300Z on March 8, 1994. The resolution is 1/5 kilometer at nadir. In the ocean the convention is that high sea surface temperatures are assigned dark gray shades while low sea surface temperatures are assigned light gray shades. Chesapeake Bay and Pamlico Sound are located along the left side of the image. The cool waters in the northern Bay and along shore in the ocean are light gray and the warmer water offshore is darker. Clouds appear white along the top of the image. Isotherms (lines of equal sea surface temperature) are drawn interactively with a mouse and software that was developed at the Ocean Products Center. Surface isotherms are in degrees C and are labeled for clarification. This chart is now available via radiofax once a week for fishermen or other interested users in the Bay and up to 100 miles offshore. It is transmitted at 1006Z on Fridays at 3242.5 KHz. However, the frequency may change in May 1994. Contact me at (301) 763-8294 for additional information.

Labradoc

Skip Gillham

*The return to calm seas found **Labradoc** with its deck awash but still floating.*
Photo courtesy of Ken Lowes.

The Great Lakes are better known for their fall storms, but spring can also bring severe weather to the inland seas as the crew of the Canadian freighter ***Labradoc*** unfortunately learned on April 6, 1979.

Built at Lauzon, Quebec, and launched Nov. 24, 1965, it traded on the Great Lakes and St. Lawrence with occasional forays on deep sea runs for the N.M. Paterson & Sons fleet.

The 96-meter (315 foot) ship had loaded 160,000 bushels of corn, its first cargo of the season, at Huron, Ohio and was en route to the Canada Starch Elevator at Cardinal, Ontario, Canada.

A strong low pressure system swept cold air across the Great Lakes and whipped Lake Erie with winds of 40 to 50 knots. ***Labradoc***'s cargo shifted in the turbulent waters and the vessel listed some 26 degrees to port and this increased as water swept over the deck.

At 0315 hours, distress calls went out and, true to the tradition of the sea, the 222.5-meter (730 foot) ***Canadian Mariner*** responded and stood upwind as a breakwall. Helicopters from Detroit and Mount Clemens, Michigan arrived at the site of the floundering ***Labradoc***. As the ***Labradoc*** was expected to sink, by noon 15 sailors were removed as a safety precaution. The remaining five were plucked from the rolling deck at about 1500 hours.

The sturdy vessel survived the storm. It was reboarded the following day, and once unloaded, it proceeded to Port Weller Dry Docks in St. Catharines, Ontario for repairs.

Labradoc resumed trading on May 29, 1979. It was sold late in 1988 and renamed the ***Falcon Crest***. It cleared Sorel, Quebec on January 8, 1989 to begin a new career under the flag of Malta. Having survived the Lake Erie, the ***Labradoc*** was ready to challenge ocean gales.

Ray Brown Retires and Other News

Earle Ray Brown Jr., the PMO with the most years of service, is finally hanging 'em up. Ray was not only one of the longest on the job but one of the best PMOs as well.

Ray began his Weather Service career back in 1955 in Boston with the Atlantic Weather Patrol. This was after serving 5 years in the U.S. Air Force in weather reconnaissance. From about 1963 through 1979, he was stationed at NASA's Wallops Island facility providing weather support for NASA, mostly re-entry support. They were also involved in the meteorological rocket ozone studies. Ray became the Port Meteorological Officer at Norfolk in 1980.

Ray and his wife Ann have been married for nearly 40 years and have four children and five grandchildren. They live in Virginia Beach but will eventually end up on the Eastern Shore. We wish Ray and Ann a happy retirement.

Ex PMO Dies

We were saddened to learn of the recent death of Joseph Takach in an automobile accident. Joe was the PMO for Newark from 1982 to 1988. Joe began his Weather Service career in 1954 at the Extended Forecast Section in Washington and also worked on the Atlantic Weather Project.

PMO Conference

The National Weather Service's Port Meteorological Officer's conference was held in Galveston, Texas from April 5 – 7. The conference was attended by PMOs from around the country as well as Ron Fordyce from Canada, NWS regional representatives, other NOAA officials, Captain Ben Bowditch from Lykes Lines and representatives from COMSAT. The conference was graciously hosted by Jim Nelson, PMO Houston.

The high point of the conference was a great Lasagna dinner prepared by Betty Nelson and family. Other highlights included a COMSAT demonstration of INMARSAT C and John McDonald's talk about the different communication routes that allow NWS weather observations to get into the system. NCDC was represented by Wilbur Biggs and Tom Reek both of whom discussed the problems of getting data into the climate system. Dave Feit of the Marine Forecast Branch briefed the gathering on his branch's newest weather products which were developed in response to requests from the mariners. The Marine Forecast Branch has successfully used the Log to advertise their products. The editor and assistant editor of the Log also participated.

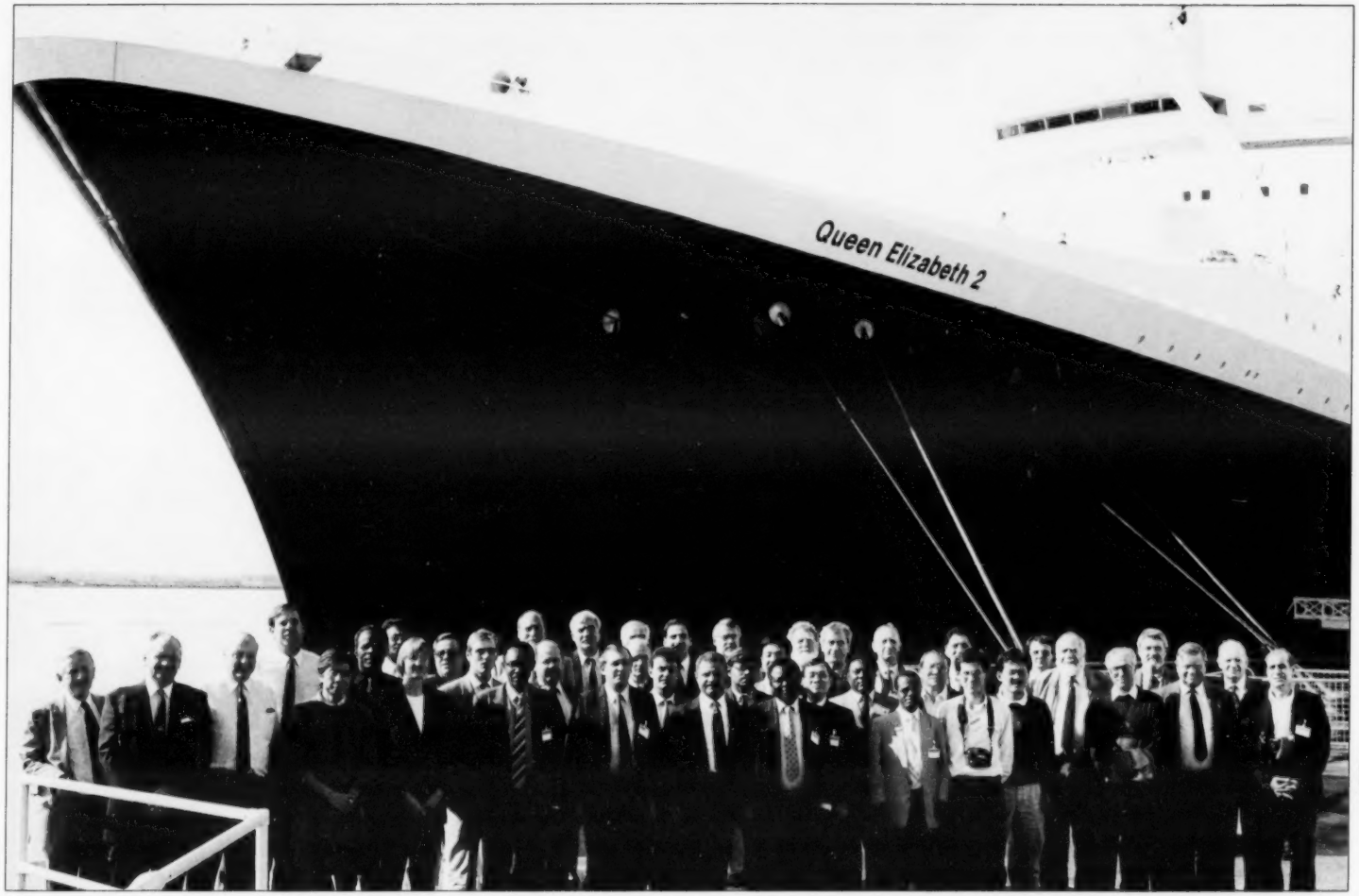
During the conference there was a visit to AMOCO Marine for a briefing on how their shipping companies use the weather services and contribute to the VOS program. This was followed by a visit to the Houston area Weather Service office for a tour by MIC Bill Read and an informative briefing on NEXRAD.

Awards included a plaque to Ray Brown, PMO Norfolk, for his many fine years of service to Jim Saunders for his outstanding performance in establishing the Baltimore office and Jack Warrelmann for the number of ships visited. Vince Zegowitz, Program Leader, received a special plaque from the PMOs for his outstanding efforts over the years on their behalf.

Here is Ray in 1980 after more than 50 Ocean Weather Station voyages on various U.S. Coast Guard and MSTS vessels. In 1991 Ray reached a milestone after visiting his ten thousandth ship as a PMO. He may look a little older (see PMO Conference photo) today but he may have lost a few pounds over the years with the very physical life that a PMO leads.

Port Meteorological Officers at the conference (above): Bob Novak (Oakland), Jim Nelson (Houston), Jim Saunders (Baltimore), Larry Cain (Jacksonville), Ray Brown (Norfolk), Bob Webster (Long Beach), Jack Warrelmann (New Orleans), Dave Bakeman (Seattle), Charles Henson (Miami), Marty Bonk (Newark) and George Smith (Cleveland).

Port Meteorological Officer Conference attendees (below): left to right– Ron Fordyce (AES Canada), Vince Zegowitz (VOS, NWS), Jim Nelson (PMO), Bob Novak (PMO), Pat Capron (NWS), James Schroeder (Central Region, NWS), Nancy O'Donnell (Associate Editor, NODC), Ray Brown (PMO), Jim Saunders (PMO), Duane Carpenter (PMO), Bob Webster (PMO), Larry Cain (PMO), John McDonald Communications, NWS), Dave Bakeman (PMO), Jack Warrelmann (PMO), Charles Henson (MO), Marty Baron (VOS, NWS), Marty Bonk (PMO), George Smith (PMO), Wilbur Biggs (NCDC), Dave Lamb (Western Region, NWS) and Bill Sites (NOAA Corps).



The attendees at the Port Meteorological Officers Seminar and Workshop in London, England in September of 1993 included (from left to right): Captain John F. T. Houghton, Captain Gordon Mackie, Captain S. Norwell, Ron Fordyce, Tadashi Asoh, Davie N. Wambura, Goonasilan Soopramania, Julie Fletcher, F. Guzman, Yann Prigent, Sory Diallo, Jurgen Guhne, Captain Edward O'Sullivan, Tor Inge Mathiesen, Luis Oscar Arnouil, Captain Douglas R. McWhan, Captain J. Steel, Eric Alfaro, Hector O. Sosa, Mahmud Rajkhan, Peter Dexter, S. K. Subramanin, Yu Zhaoguo, Jubril O. Ojukotola, Andre Bellocq, Ip Sui Fui, Jozef Kowalewski, Ali Juma Mafimbo, John Erik Rossel, Ismail Fadl el Mula, Edmund Lee Mun San, Jose Serra, Kwon O-ung, Ng Kim Lai, Michel Hontarrede, Captain A. Ashton, George Kassimidis, George E. Venendaal, Captain Cliff R. Downes, Captain M. L. Coombs, Abdollah Trabali.

Congratulations to Captain William E. Cline in his new command as Grand President of the International Shipmasters Association. This was the 108th anniversary of the Grand Lodge Convention which was hosted by the Port Huron Michigan Lodge this past January. The photograph above was taken just after the installation ceremony. Captain Cline is seated front row, center behind the ISMA flag. In the back row, second and third from the right are Port Meteorological Officers, George Smith from Cleveland and Ron Fordyce from Canada. Both PMOs made presentations to the convention on their respective marine programs including summaries of the Great Lakes VOS Program.

Thumbs up– apparently the Captain and Bridge Officers of the Matson Navigation Co. vessel mv ***R.J. Pfeiffer*** *approve of the SEAS Standard C software program. They are left to right: First Officer B.J. Diggins, seated Captain Gary Schmidt and Second Officer Randy Raeber. Steve Cook of the NOS SEAS program took some time out of his busy schedule to accompany the* ***R.J. Pfeiffer*** *on this experimental/training run from Los Angeles to Honolulu. The initial results were encouraging and Cook's tan was quite noticeable. All messages, both ASCII and Compressed Binary were transmitted from the ship, received at COMSAT and properly decoded. Additionally, all transmitted acknowledgements and ASCII messages were successfully received at sea. Many thanks to Matson Navigation Co. for their help in this test.*

South Pacific Tropical Cyclones Joni and Kina

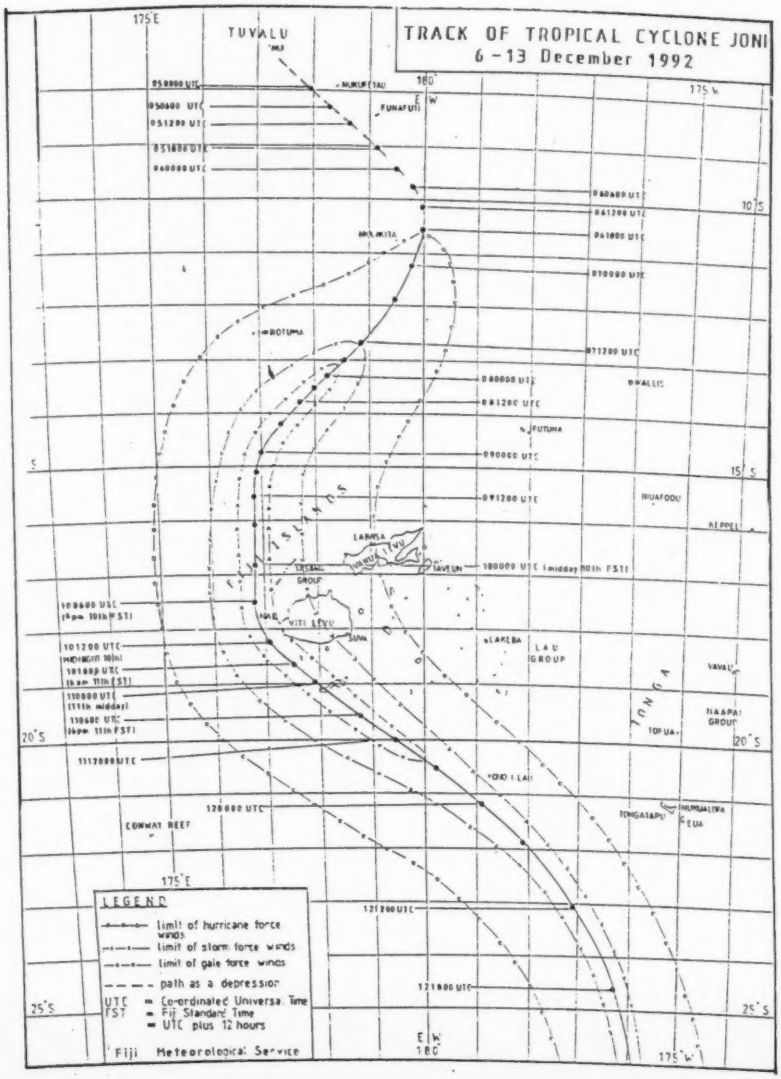
Fiji Meteorological Service

Tropical Cyclone Joni developed from a depression along the South Pacific convergence zone near Tuvalu on December 6th and progressed southward to pass over the western and southwestern part of the Fiji Group during the 10th and 11th. The cyclone reached peak intensity with estimated average winds of 90 knots and gusts of 130 knots close to the center as it approached the Group.

Joni, a relatively small but intense tropical cyclone, had a total lifespan of about 7 days. It had a relatively small eye with very destructive winds confined to the center.

Fiji suffered damage estimated at around $1.5 million (Fiji) from this cyclone. The areas affected most were the Yasawa and Mamanuca Groups, western and southwestern parts of Viti Levu, Kadavu, Vatulele and nearby smaller islands. Joni also affected Tuvalu during early stages of development causing minor damage.

Joni was the first cyclone to affect Fiji and Tuvalu in the 1992–93 Tropical Cyclone Season. Since Joni was in its early stages of development when it passed Tuvalu, damage over the Group was minor except for Niulakita which experienced damaging gale



force winds occasionally rising to destructive storm force in squalls. Over Fiji, the effect was moderate to severe especially in the western and southwestern parts of the Group. Survey reports indicate that major damage was caused to crops and vegetation while close to the cyclone path. Heavy rainfall in some areas resulted in severe floods which caused significant loss of livestock. One tragic loss of life occurred when an 11-year-old boy was electrocuted when he stepped on live wire while gathering fallen fruit.

Tropical Cyclone Kina

Kina was the second tropical cyclone to occur in the area of responsibility of the Nadi Tropical Cyclone Warning Center (TCWC) during the 1992-1993 Southwest Pacific Tropical Cyclone Season. It was also the second to hit Fiji within a month, causing some of the most severe devastation in recent times.

Originating from a tropical depression just east of the Solomons on December 26th, Kina initially moved very slowly in a general direction of Fiji and developed steadily. It reached peak intensity by late on the 29th with an estimated maximum average winds of 75 to 80 knots and momentary gusts of 120 knots close to its center. It maintained this intensity for nearly half of a total lifespan of about 9 days as a tropical cyclone.

Embedded in a changing upper-level environment and influenced by other weather systems including tropical cyclone Nina which formed in the Australian Gulf of Carpentaria and moved rapidly eastwards across the Coral Sea, Kina followed a rather distinct and erratic path that resulted in the cyclone center passing between Fiji's two main islands of Viti Levu and Vanua Levu and directly over the old capital of Levuka on Ovalau during the night of January 2nd. The cyclone later crossed Southern Lau and also threatened Southern Tonga, passing about 60 miles southwest of Nuikualofa at its closest proximity.

Fiji suffered its greatest ever financial loss due to a tropical cyclone with destruction or damage to houses, property, infrastructure and crops valued at nearly $170 million (U.S. $110 million). At least 23 deaths occurred, several others were reported missing, and there was an unaccountable loss of livestock. Prolonged heavy rainfall brought by Kina, with a combination of high tides and heavy seas basically blocked the mouths of major rivers caused the worst flooding experienced in over 60 years, accounting for much of the loss. Heavy damage was also sustained in Tonga where at least three died.

The rather peculiar path of Kina led to the cyclone causing severe effects over Fiji, parts of which experienced the full brunt of a cyclone for the first time in over 20 years and moderate danger over Southern Tonga.

Rainbands from Kina started to affect Fiji from December 28th, causing some heavy rainfall in the interior and eastern parts of its main islands. Winds in most of the Group became strong late on the 1st of January and gradually increased to gale force on the morning of the 2nd over Yasawa and Mamanuca Groups, and from later that afternoon in the rest of the Western and Northern Divisions. Rain also became frequent and heavy. As Kina approached and passed overhead or close to Yasawas, northern and eastern Viti Levu, southwestern Vanua Levu, and Lomaiviti and Lau Groups between the night of the 2nd and the afternoon of the 3rd, winds became destructive and rain became torrential.

Kina's path resulted in most parts of the Fiji Group suffering moderate to severe damage. The country was battered by winds averaging up to about 80 knots and momentary gusts to 120 knots. Prolonged heavy rain and resultant massive overflow of the country's major rivers caused extensive flooding, which in some cases was the worst experienced in over 60 years. This was the major cause of loss of lives and destruction. The northern and eastern parts of Viti Levu and some islands in the Lomaiviti Group and Southern Lau were declared the worst hit.

A number of landslides especially about the interior of Viti Levu cut the road access to settlements inland. Crop damage especially in the Sigatoka and Navua/Nausori areas was severe with almost total losses. In some cases, all farm machinery and equipment were washed away. Loss to livestock especially in the eastern part of Viti Levu was significant enough to threaten the dairy and meat industries.

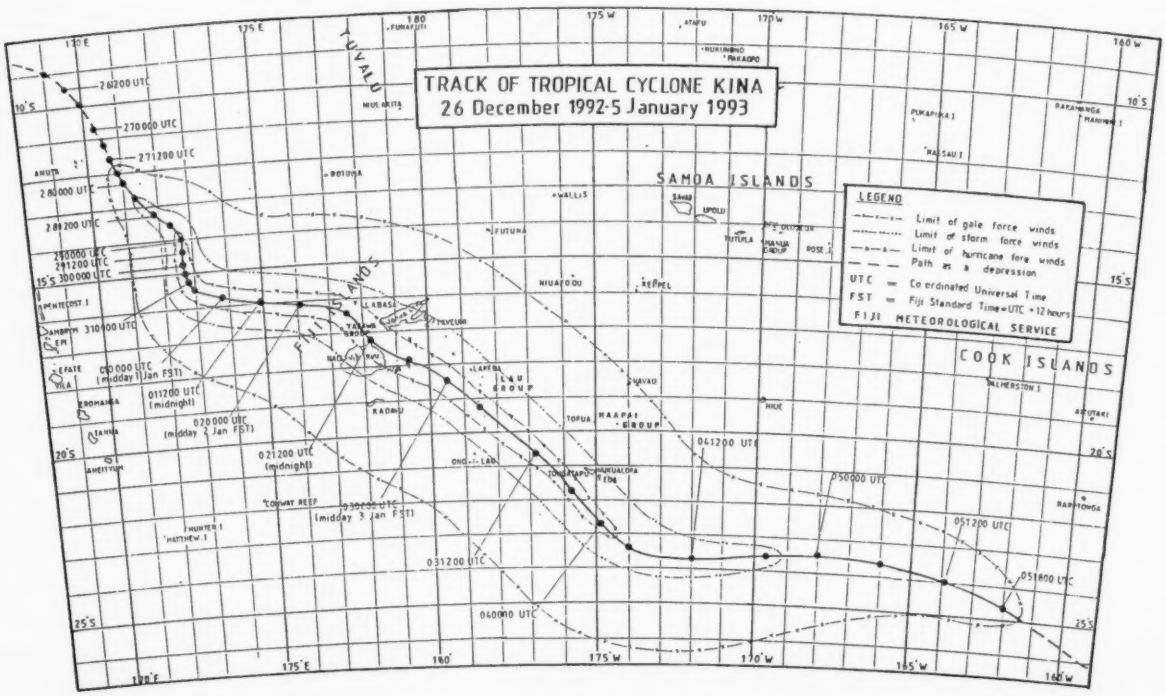
In total, 23 lives were lost mostly as a result of drowning or being struck by flying objects.

At Tonga, major damage was confined to the Tongatapu Group, the southern-most islands of Tonga as Kina passed closest to these islands. Damage to food crops, especially banana and breadfruit on Tongatapu was severe while that to dwellings was minimal.

Tropical Cyclone Kina, December 26, 1992 to January 5, 1993

Station Name	Main AV Winds (Kts) and Time (UTC)	Max Gust (kts)	Lowest Pressure Recorded (millibars)
Tuvalu			
Funafuti	30 / 051500	52	1001.1
Niulakita	57*/ 061400	68	997.4
Fiji			
Yasawa	48 / 100000	65	990.0
Viwa	75 / 100300	84	957.0
Nadi Airport	55 / 101035	95	995.3
Vunisea (Kadavu)	80 / 110300	110	985.2
Matuku	35 / 111600	65	1000.1
Ono-i-Lau	35 / 112000	46	997.5
Nausori Airport	38 / 101340	55	1000.7
Laucala Bay	25 / 101400	52	1000.1

*This reading is an over-estimate of the actual sustained wind. The high figure could possibly be due to the gust or the squalls due to heavy convection over the island.



Throw your trash overboard, and you could be dropping a bundle.

It's dark. You think nobody's watching. Why not toss that plastic trash bag overboard? Because if you do, you're throwing away a lot more than just the day's garbage. You're committing a class D felony, now punishable by imprisonment for up to six years and a corporate fine of up to $500,000.

Why the new penalties? Because our oceans aren't capable of absorbing unlimited amounts of trash. And a lot of people are tired of finding other people's garbage on their beaches.

So stow your trash on board for proper disposal on land. It's an idea the whole world can live with. And it can save you a bundle.

To find out more, write: The Center for Marine Conservation, PSA-CM, 1725 DeSales Street, N.W., Suite 500, Washington, D.C. 20036.

A public service message from:
The Center for Marine Conservation
The National Oceanic and Atmospheric Administration
The Society of the Plastics Industry

North Pacific and North Atlantic Surface Charts

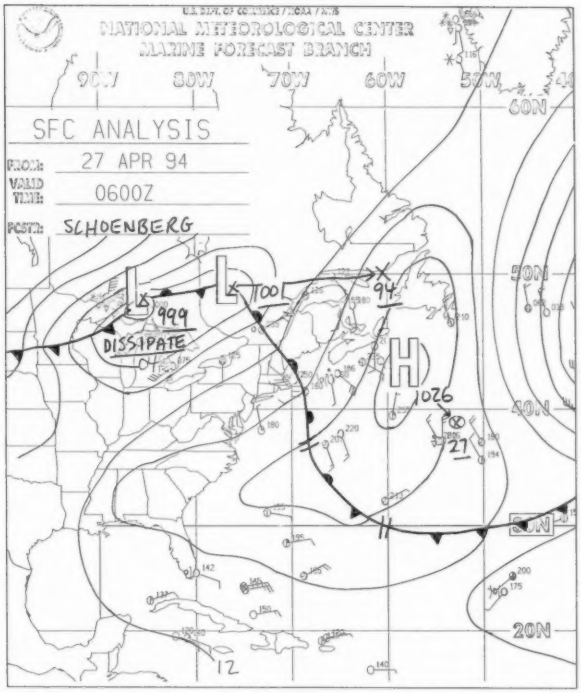
Lee Chesneau
National Weather Service

The National Weather Service is responsible for issuing marine forecasts and warnings. Most of these products are graphics and prepared by the National Meteorological Center (NMC) and distributed by high frequency radiofacsimile broadcast. North Atlantic products are broadcast via the US Coast Guard Communications Center at Marshfield, Massachusetts while the North Pacific products are broadcast from Point Reyes, California. Each ocean base map is a Mercator projection and has latitude and longitude markings in 10 degree increments. Regional products use polar stereographic projection.

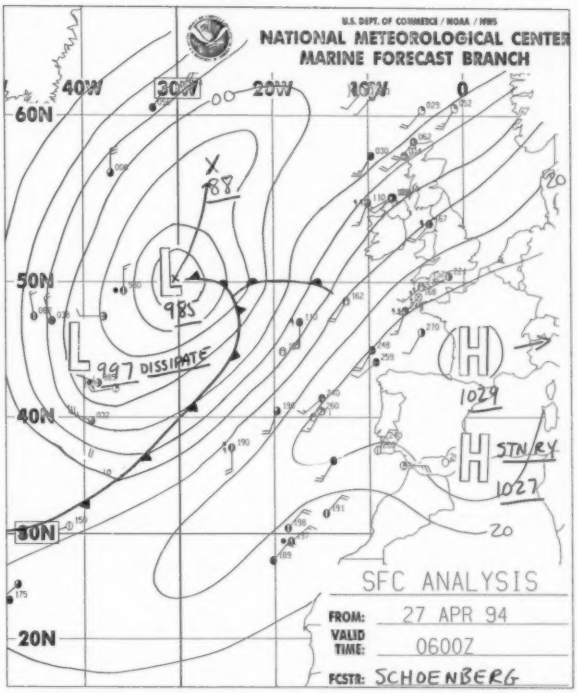
We realize that vessels engaged in national and international trade with fast turn around times require timely presentation of meteorological and oceanographic information. The Marine Forecast Branch also recognizes that radiofacsimile is currently the most widely used medium by ships for receiving analyses and forecasts. Three primary types of products are issued– upper air 500 millibar charts, surface pressure and sea state charts. Additional charts include sea surface temperature and satellite imagery. In the next several issues of the Log, the Marine Forecast Branch has agreed to cover in detail the basic charts that are issued, starting with the surface analysis products.

Surface Analyses

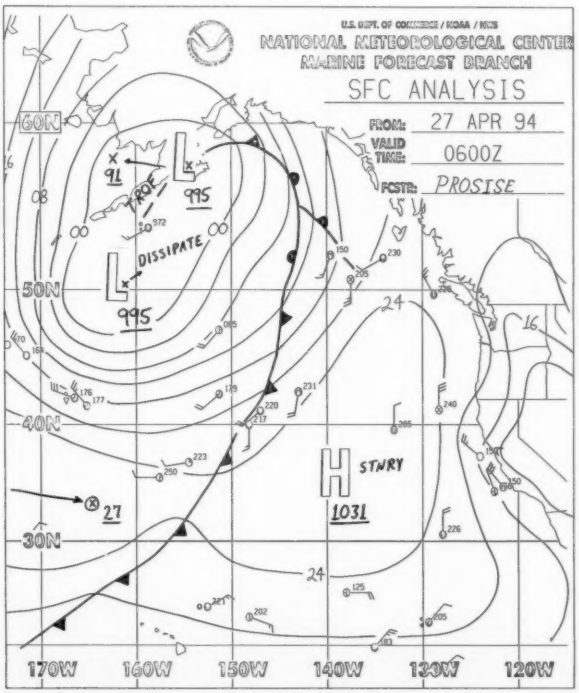
The surface analyses are produced four times per day (00Z, 06Z, 12Z and 18Z) for each ocean. These charts consists of isobaric pressure analyses at 4 millibar contour intervals and are labeled every 8 millibars. The central pressure values of low and high pressure systems are three or four digits which are bold and underlined (i.e. **980**). The surface charts also show abbreviated automated ship plots of wind direction (8 point compass rose), wind speed (in knots), present weather (using standard symbols) and cloud cover amount. The chart is issued in two parts, which overlap by some 10 degrees of longitude. Both sections will also depict the low or high pressure system's projected 24–hour forecast position by way of a vector or line to that 24–hour position labeled as an "X" for lows and a Ⓧ for highs with a bold underlined two digit central pressure in millibars. These new surface analyses have been doubled in size to allow the mariner to use them as work charts. These surface analyses will be broadcast approximately 3½ hours from the valid synoptic time (with the exception of the 12Z Atlantic Surface Analysis Chart).

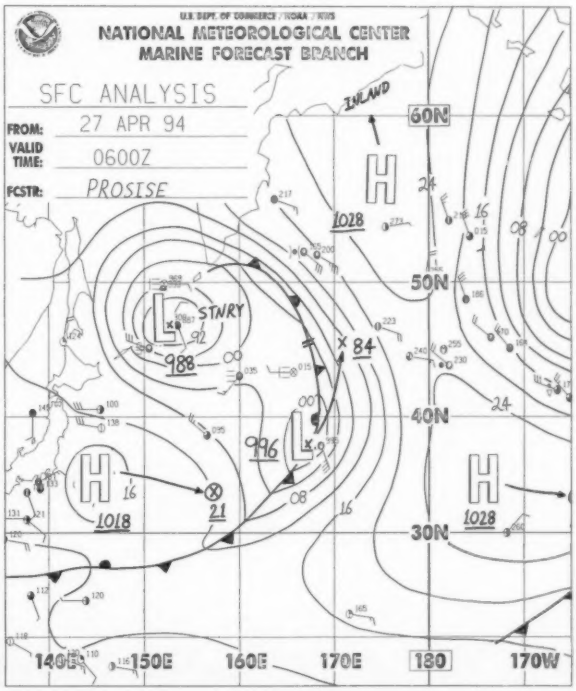

NATIONAL METEOROLOGICAL CENTER
MARINE FORECAST BRANCH
SFC ANALYSIS
FROM: 27 APR 94
VALID TIME: 0600Z
FCSTR: SCHOENBERG
DISSIPATE
1026
60N
50N
40N
30N
20N

PART 1


U.S. DEPT. OF COMMERCE / NOAA / NWS
NATIONAL METEOROLOGICAL CENTER
MARINE FORECAST BRANCH
997 DISSIPATE
1029
STNRY
1027
SFC ANALYSIS
FROM: 27 APR 94
VALID TIME: 0600Z
FCSTR: SCHOENBERG

PART 2


NATIONAL METEOROLOGICAL CENTER
MARINE FORECAST BRANCH
SFC ANALYSIS
FROM: 27 APR 94
VALID TIME: 0600Z
FCSTR: PROSISE
DISSIPATE
STNRY
1031
170W
160W
150W
140W
130W
120W


NATIONAL METEOROLOGICAL CENTER
MARINE FORECAST BRANCH
SFC ANALYSIS
FROM: 27 APR 94
VALID TIME: 0600Z
FCSTR: PROSISE
INLAND
1028
STNRY
1018
1028
140E
150E
160E
170E
180
170W

GOES–8 Weather Satellite in Orbit

Pat Viets
NESDIS

GOES-I (Geostationary Operational Environmental Satellite) was successfully launched April 13, 1994 from Cape Canaveral Air Force Station, Florida. The satellite promises to provide more precise and timely weather observations and atmospheric measurement for mariners and meteorologists alike. It is critical for the upcoming tropical cyclone season.

GOES–I, the first in a series of five advanced weather satellites to be launched into space over the next several years, was renamed GOES–8 after achieving orbit. On the 27th of April, a final apogee adjust maneuver was made. This thruster firing lowered the apogee and raised the perigee of GOES–I and placed it into its final geosynchronous orbit.

Its three–axis stabilized design allows the satellite sensors to continuously watch the earth for 24–hour observation. Current spin–stabilized satellites view the earth only 5% of the time.

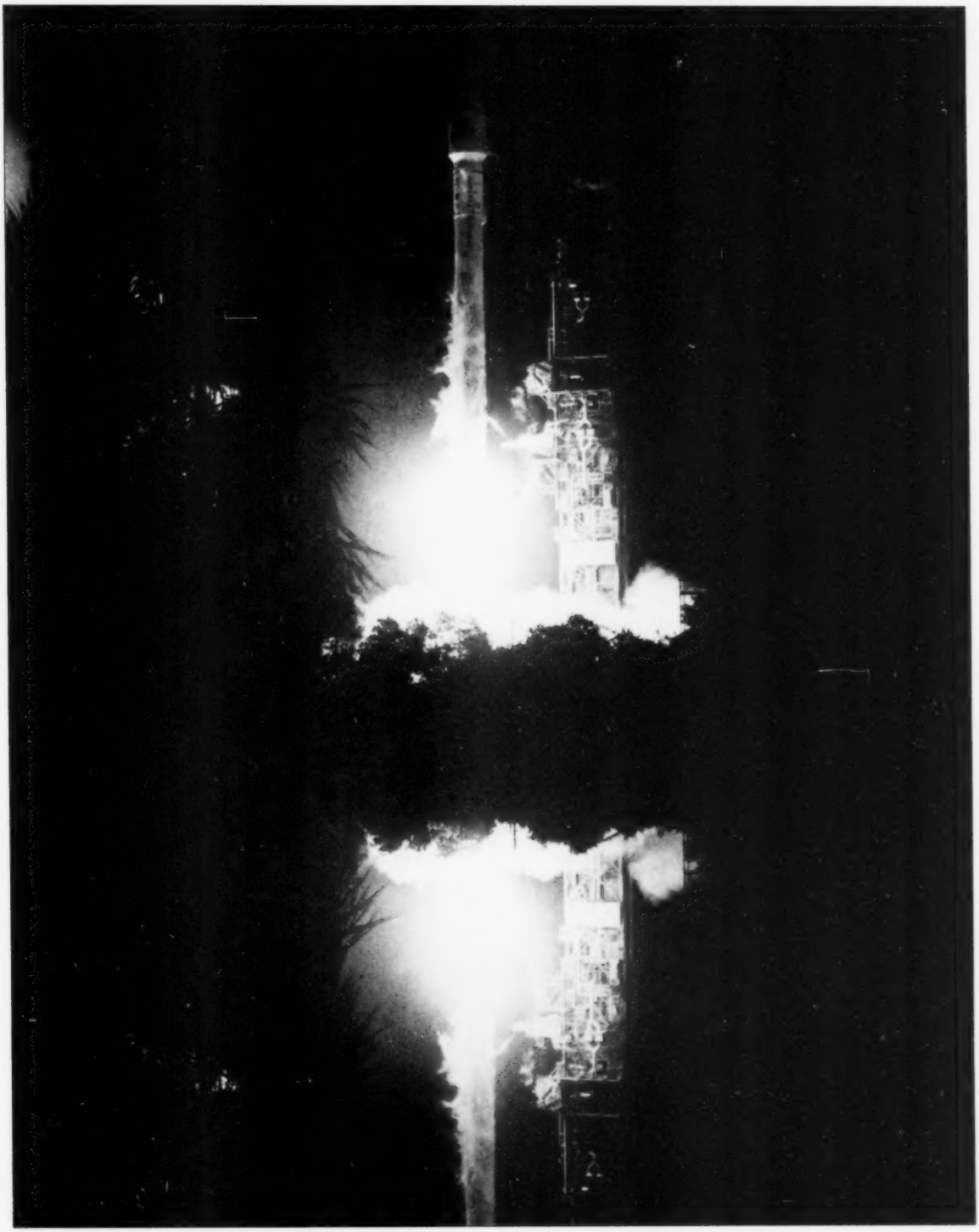
The GOES series of satellites is owned and operated by the National Oceanic and Atmospheric Administration (NOAA). The National Aeronautics and Space Administration's (NASA) Mission to Planet Earth manages the design, development and launch of the spacecraft. Once the satellite operationally completes "check–out," NOAA will assume responsibility for command and control, data receipt, product generation and distribution.

During check–out, the satellite will be positioned at 90°W longitude. After 180 days, GOES–8 becomes operational. Plans calls for GOES–7, launched 7 years ago, to be moved from 112°W to 135°W. GOES–7 while still operational has outlived its expected lifetime. GOES–8 will eventually be moved to 75°W.

The next satellite in the GOES series, GOES–J, is planned for launch in April 1995. It will replace GOES–7, which is planned to be used as a backup. The next three satellites in the GOES series will be launched as required to support NOAA's dual–satellite geostationary observing system.

The GOES I–M satellites are built by Space Systems/Loral. NASA's Lewis Research Center is responsible for launch services, provided on an Atlas I rocket, under contract with General Dynamics. The satellites are operated by NOAA's National Environmental Satellite, Data, and Information Services (NESDIS).

The Atlas 1 (right) carries the GOES–I, the first of five next–generation advanced weather satellites for NOAA. The launch from Cape Canaveral Air Force Station took place on April 13, 1994 at 2:04 A.M. EDT. Photo courtesy of NASA.



Changes to Radiofacsimile Schedule

Jim Nelson
NWS

EFFECTIVE 2 MAY 1994

MARSHFIELD, MASSACHUSETTS, U.S.A.

CALL SIGN	FREQUENCIES	TIMES	EMISSION	POWER
NMF	6340.5 kHz	CONTINUOUS	F3C	10 KW
	12750 kHz	CONTINUOUS	F3C	10 KW

TRANS TIME	CONTENTS OF TRANSMISSION	RPM/IOC	VALID TIME	MAP AREA
0300/1730	HEADER	120/576		
0305/------	FAX SCHEDULE	120/576		
0315/------	SATELLITE IMAGERY	120/576	0000	
0325/1735	SURFACE ANAL (PART 1)	120/576	00/12	
0338/1748	SURFACE ANAL (PART 2	120/576	00/12	
0351/------	500MB ANAL	120/576	0000	
------/1835	HEADER	120/576		
0401/1840	SURFACE ANAL (PART 1)	120/576	00/12	
0414/1853	SURFACE ANAL (PART 2)	120/576	00/12	
------/1906	500MB ANAL	120/576	1200	
------/1916	SEA STATE ANAL	120/576	1200	
------/1926	96HR 500MB PROG	120/576	0000	
------/1936	96HR SURFACE PROG	120/576	0000	
------/1946	GULF STREAM ANAL	120/576	LATEST	
0800/2015	HEADER	120/576		
0805/2020	24HR WEATHER DEPICTION PROG	120/576	00/12	
0815/2030	24HR WIND WAVE PROG	120/576	00/12	
0825/2040	48HR SURFACE PROG	120/576	00/12	
0835/2050	48HR 500MB PROG	120/576	00/12	
0845/2100	48HR SEA STATE PROG	120/576	00/12	
0905/------	HEADER	120/576		
0910/------	LEGEND	120/576		
0920/------	REQUEST FOR COMMENTS	120/576		
------/2110	SATELLITE IMAGERY (ANNOTATED)	120/576	1800	
0930/2120	SURFACE ANAL (PART 1)	120/576	06/18	
0943/2133	SURFACE ANAL (PART 2)	120/576	06/18	
0956/------	SATELLITE IMAGERY (ANNOTATED)	120/576	0600	
1006/------	GULF STREAM ANAL (PART 1)	120/576	LATEST	
1016/------	GULF STREAM ANAL (PART 2)	120/576	LATEST	
1026/2146	SURFACE ANAL (PART 1)	120/576	06/18	
1039/2159	SURFACE ANAL (PART 2)	120/576	06/18	

NOTES: COMMENTS AND SUGGESTIONS SHOULD BE DIRECTED TO:

NATIONAL WEATHER SERVICE/NOAA
NATIONAL METEOROLOGICAL CENTER
MARINE FORECAST BRANCH W/NMC31
5200 AUTH ROAD
WASHINGTON DC 20233
PHONE: (301) 763-8442/FAX: (301) 899-8903

(INFORMATION DATED 04/1994)

PEARL HARBOR, HAWAII, U.S.A.

CALL SIGN	FREQUENCIES	TIMES		EMISSION	POWER
NPM	4855 kHz	0600-1600*	LSB/ISB	F3C	40 KW
	6453 kHz	CONTINUOUS&	USB/ISB	F3C	40 KW
	8494 kHz	CONTINUOUS#	LSB	F3C	40 KW
	9090 kHz	CONTINUOUS&	USB/ISB	F3C	40 KW
	21735 kHz	1600-0600*	LSB/ISB	F3C	40 KW

* PEARL HARBOR FREQUENCIES # ADAK, AK FREQUENCY & STOCKTON, CA FREQUENCY

TRANS TIME	CONTENTS OF TRANSMISSION	RPM/IOC	VALID TIME	MAP AREA
0000/------	FFAX SCHEDULE PART 1 (WED & SAT)	120/576		
	SEA SURFACE TEMP ANAL (HAWAII AREA) (SUN)	120/576	1200	6
	SEA SURFACE TEMP ANAL (SWPAC) (MON)	120/576	1200	7
	STORM TRACK (TUE)	120/576		8
	SEA SURFACE TEMP ANAL (SOCAL) (THU)	120/576	1200	9
	SONIC LAYER DEPTH (WPAC) (FRI)	120/576	1200	1
------/1200	48HR 500MB PROG (WPAC)	120/576	0000	1
0015/------	FFAX SCHEDULE PART 2 (WED & SAT)	120/576		
	SEA SURFACE TEMP ANAL (NOCAL) (SUN & THU)	120/576	1200	10
	SEA SURFACE TEMP ANAL (NWPAC) (MON)	120/576	1200	11
	SONIC LAYER DEPTH (EPAC) (FRI)	120/576	1200	2
------/1211	OPEN			
0029/1229	36HR SURFACE PROG BLEND	120/576	1200	5
0059/1259	24HR SIGNIFICANT WAVE PROG (EPAC)	120/576	12/00	2
0110/1310	36HR SIGNIFICANT WAVE PROG	120/576	00/12	5
0120/1320	48HR SIGNIFICANT WAVE PROG (EPAC)	120/576	12/00	2
0131/1331	SIGNIFICANT WAVE ANAL (POLAR)	120/576	12/00	3
0142/1342	12HR SURFACE PROG (POLAR)	120/576	00/12	4
0153/1353	24HR SURFACE PROG (POLAR)	120/576	12/00	4
0204/1404	24HR 850MB PROG (EPAC)	120/576	12/00	2
0215/1415	24HR 700MB PROG (EPAC	120/576	12/00	2
0226/1426	24HR 400MB PROG (EPAC)	120/576	12/00	2
0237/1437	24HR 300MB PROG (EPAC)	120/576	12/00	2
0248/1448	24HR SIGNIFICANT WAVE PROG (WPAC)	120/576	12/00	1
0259/1459	48HR SIGNIFICANT WAVE PROG (WPAC)	120/576	12/00	1
0310/1510	24HR 850MB PROG (WPAC)	120/576	12/00	1
0321/1521	24HR 700MB PROG (WPAC)	120/576	12/00	1
0332/1532	24HR 400MB PROG (WPAC)	120/576	12/00	1
0343/1543	24HR 300MB PROG (WPAC)	120/576	12/00	1
0354/1554	24HR SIGNIFICANT WAVE PROG (POLAR)	120/576	12/00	3
0405/1605	48HR SIGNIFICANT WAVE PROG (POLAR)	120/576	12/00	3
0416/------	24HR 500MB LONG WAVE PROG (POLAR)	120/576	1200	3
------/1616	72HR SURFACE PROG (EPAC)	120/576	0000	2
0427/------	48HR 500MB LONG WAVE PROG (POLAR)	120/576	1200	3
------/1627	72HR SURFACE PROG (WPAC)	120/576	0000	1
0438/1638	TROPICAL WARNINGS/OPEN PERIOD	120/576	LATEST	
0544/------	SATELLITE IMAGERY (GOES C-SECTOR IR)	120/576	LATEST	
------/1744	SATELLITE IMAGERY (GOES C-SECTOR VISUAL)	120/576	LATEST	
0559/1759	OPEN			
0630/1830	SURFACE ANAL (NPAC)	120/576	00/12	
0700/1900	OPEN			
0844/------	SATELLITE IMAGERY (GOES C-SECTOR IR)	120/576	LATEST	
------/2044	SATELLITE IMAGERY (GOES C-SECTOR VISUAL)	120/576	LATEST	
0859/2059	OPEN			
0915/2115	500MB ANAL	120/576	00/12	2
0926/2126	500MB ANAL	120/576	00/12	1
0937/2137	24HR SURFACE PROG (EPAC)	120/576	00/12	2
0948/2148	24HR SURFACE PROG (WPAC)	120/576	00/12	1
0959/2159	48HR SURFACE PROG (EPAC)	120/576	00/12	2
1010/2210	48HR SURFACE PROG (WPAC)	120/576	00/12	1
1021/2221	36HR SURFACE PROG (EPAC)	120/576	00/12	2
1032/2232	36HR SURFACE PROG (WPAC)	120/576	00/12	1
1043/2243	SIGNIFICANT WAVE ANAL (EPAC)	120/576	00/12	2
1054/2254	SIGNIFICANT WAVE ANAL (WPAC)	120/576	00/12	1
1105/2305	24HR 500MB PROG (EPAC)	120/576	00/12	2
1116/2316	24HR 500MB PROG (WPAC)	120/576	00/12	1
1127/2327	48HR 500MB PROG (EPAC)	120/576	00/12	2
1138/2338	OPEN			
1144/------	SATELLITE IMAGERY (GOES C-SECTOR IR)	120/576	LATEST	
------/2344	SATELLITE IMAGERY (GOES C-SECTOR VIS)	120/576	LATEST	

continued

PEARL HARBOR, HAWAII, U.S.A.

MAP AREAS: CHART PROJECTION ASSUMES A 19 INCH RECORDER.

WPAC	1	1:13,000,000 60N 123E, 60N 162W, 05N 123E, 05N 162W
EPAC	2	1:13,000,000 60N 168W, 60N 093W, 05N 168W, 05N 093W
POLAR	3	1:05,000,000 38N 100E, 42N 080W, EQ 160E, EQ 140W
POLAR	4	1:05,000,000 55N 110E, 60N 090W, 30N 165E, 28N 140W
	5	1:13,000,000 60N 150E, 60N 110W, 05N 150E, 05N 110W
HAWAII	6	1:05,000,000 12N 170W, 40N 170W, EQ 145W, 30N 135W
SWPAC	7	1:05,000,000 EQ 170E, 34N 160E, 05N 165W, 38N 165W
	8	1:13,000,000 60N 110E, 60N 115W, EQ 110E, EQ 115W
SOCAL	9	1:05,000,000 25N 135W, 45N 120W, 15N 120W, 25N 105W
NOCAL	10	1:05,000,000 35N 170E, 65N 170W, 30N 140W, 50N 115W
NWPAC	11	1:05,000,000 30N 160E, 50N 135W, 30N 165W, 65N 165W

NOTES: 1. CONTENTS OF THIS SCHEDULE MAY CHANGE WITHOUT NOTICE DUE TO U.S. NAVY OPERATIONAL REQUIREMENTS.
2. COMMENTS CONCERNING QUALITY AND CONTENT ARE SOLICITED. ADDRESS COMMENTS TO:

NAVAL PACIFIC METEOROLOGY AND OCEANOGRAPHY CENTER
BOX 113
PEARL HARBOR, HI 96860-5050 U.S.A.

(INFORMATION DATED 03/1994)

WELLINGTON, NEW ZEALAND

CALL SIGN	FREQUENCIES	TIMES	EMISSION	POWER
ZKLF	5807 kHz	CONTINUOUS	F3C	5 KW
	9459 kHz	CONTINUOUS	F3C	5 KW
	13550 kHz	CONTINUOUS	F3C	5 KW
	16340.1 kHz	CONTINUOUS	F3C	5 KW

TRANS TIME	CONTENTS OF TRANSMISSION	RPM/IOC	VALID TIME	MAP AREA
0000/1200	18HR SIGNIFICANT WEATHER PROG	120/576	12/00	NREG
0100/1400	30HR 700MB PROG	120/576	18/06	NREG
0115/1415	30HR 500MB PROG	120/576	18/06	NREG
0130/------	30HR 250MB PROG	120/576	1200	NPAC
------/1430	30HR 250MB PROG	120/576	0600	NREG
------/1445	18HR SIGNIFICANT WEATHER PROG	120/576	0000	NPAC
0300/1500	SURFACE ANAL (MSL)	120/576	00/12	TNZ
0315/1515	SURFACE ANAL (MSL)	120/576	00/12	SWP
0400/------	18HR SIGNIFICANT WEATHER PROG	120/576	1200	ASIA
------/1600	30HR SURFACE PROG	120/576	1200	SWP
------/1615	18HR SIGNIFICANT WEATHER PROG	120/576	0000	ASIA
0430/1630	12HR MARINE SIGNIFICANT WEATHER PROG (MSL)	120/576	12/00	SWP
0445/1645	FAX SCHEDULE	120/576		
------/1745	30HR/48HR SWELL PROG	120/576	18/12	NZ
0600/------	30HR/48HR SWELL PROG	120/576	06/00	NZ
0615/------	18HR SIGNIFICANT WEATHER PROG	120/576	1800	NREG
------/1900	18HR SIGNIFICANT WEATHER PROG	120/576	0600	NREG
0715/------	18HR 250MB PROG	120/576	1800	NREG
0730/------	24HR 700MB PROG	120/576	0000	NREG
0745/------	24HR 500MB PROG	120/576	0000	NREG
0800/2000	SURFACE ANAL (MSL)	120/576	06/18	TNZ
0815/------	18HR SIGNIFICANT WEATHER PROG	120/576	18/06	NPAC
------/2015	18HR 250MB PROG	120/576	1200	NREG
------/2230	24HR 700MB PROG	120/576	1200	NREG
------/2045	24HR 500MB PROG	120/576	1200	NREG
------/2100	18HR SIGNIFICANT WEATHER PROG	120/576	0600	NPAC
------/2200	18HR SIGNIFICANT WEATHER PROG	120/576	0600	ASIA
------/2215	24HR 250MB PROG	120/576	1200	NREG
1030/2300	SURFACE ANAL	120/576	00/12	SPC
1115/2315	24HR 250MB PROG	120/576	00/12	NREG
1130/2330	12HR MARINE SIGNIFICANT WEATHER PROG	120/576	18/06	SWP
1145/------	12HR SIGNIFICANT WEATHER PROG	120/576	1800	ASIA
------/2345	30HR SURFACE PROG (MSL)	120/576	0000	SWP

MAP AREAS: DECRIPTION OF MAP AREAS NOT AVAILABLE.

(INFORMATION DATED 10/1993)

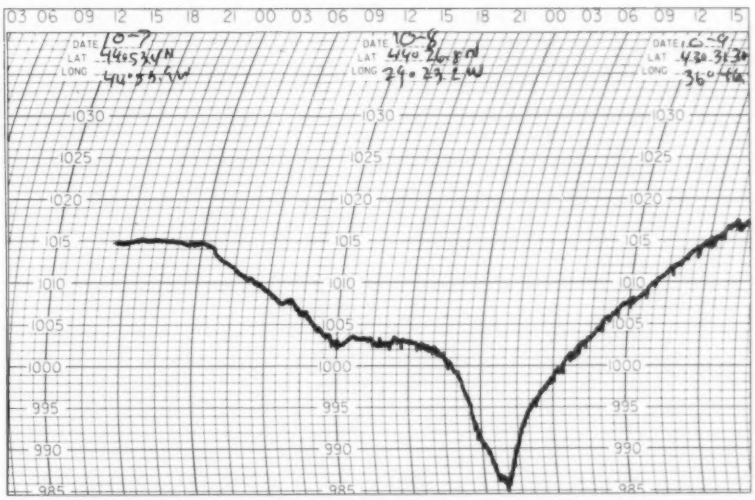
All times unless noted are UTC (universal coordinated time) and all miles are nautical. For additional detail, tropical cyclones will be covered in the annual reports from the tropical cyclone centers around the world. The weather summaries are based upon the track charts and Northern Hemisphere Surface Charts as well as ship reports and attempt to highlight the most significant ocean weather features each month. The track charts are provided by NOAA's National Meteorological Center. If an extratropical storm is particularly bad for shipping, we may designate it as the Monster of the Month. Gale reports are provided by the National Climatic Data Center at Asheville, NC.
–ed.

North Atlantic Weather
October, November, December 1993

October–The outstanding feature on the monthly mean sea level pressure chart was a high over Iceland in an area normally occupied by the Icelandic Low. This created positive pressure anomalies of 8 to 16 millibars north of 45°N from southwest of Kap Farvel to the Norwegian Sea. In the real world, few storms penetrated this region particularly during the first half of the month. A large High over Greenland was the main culprit. This feature was even reflected at the 500-millibar level where a ridge was apparent from south of Iceland to northern Greenland.

Despite the presence of high pressure, a wicked storm made life miserable for mariners traversing the eastern North Atlantic during the first week of the month. A Low had come to life in the subtropics east of Florida during the last few days in September. It moved northward and crossed the Grand Banks on the 1st of October as a rather weak system. Turning east northeastward, it began to intensify. By 1200 on the 3rd, it crossed the 25th meridian near 57°N as a 964-millibar Low heading toward the southeast. Both the ***Galveston Bay*** (48.1°N, 22.0°W) and the ***Medallion*** (50.9°N, 26.5°W) encountered force 8 winds. Sea and swell were running about 6 to 7.6 meters (20–25 feet). Some 300 miles west of the center, the ***OVYA2*** ran into 52-knot northerlies. The storm filled somewhat as it approached the English Channel on the 5th, but gales were still being reported by vessels like the ***OOCL Inspiration*** on the 5th and 6th. It moved across England on the 6th.

On the 9th and 10th, a Low briefly intensified near mid ocean as it headed along the 45th parallel and eventually turned toward the English Channel. On the 9th, the ***Southern Princess***, ***Argonaut***, ***OOCL Inspiration***, and ***Star Evviva*** ran into 35-to 45-knot winds in 6-meter (20 foot) seas just southwest of the center. On the 12th, the 982-millibar storm



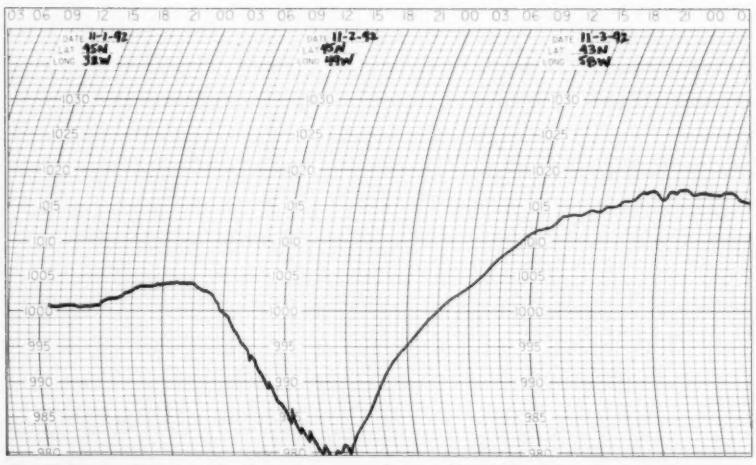
*The mv **OOCL Inspiration** was en route from Felixstowe, England to Charleston, South Carolina. It had already (text above) reported gales and then a few days later recorded this barometer trace.*

moved into the English Channel. It was still generating gale force winds.

During the second half of the month, cyclonic activity was concentrated from Newfoundland through the Denmark Strait while the eastern North Atlantic was relatively untouched. On the 25th a weak 1011-millibar Low developed over Florida and headed up the East Coast of the U.S. By the 27th, its pressure dropped below 1000 millibars, and the following day over Nova Scotia it was down to 972 millibars. Vessels such as the ***Nosac Ranger***, ***Charlotte Lykes***, ***Carolina***, NOAA ship ***Whiting***, ***Rainbow Hope*** and ***Sealand Value*** encountered force 8 winds from Cape Hatteras to Cape Cod. Seas were running 2.4 to 4.9 meters (8-16 feet) while swells of 4.6 to 6 meters (15-20 feet) were being reported. Maintaining its intensity, the Low moved across the Gulf of St. Lawrence and into the Labrador Sea as the month came to a close.

Before October was finished, however, an unusually potent extratropical storm formed north of the Canary Islands. On the 30th, a 985-millibar Low was centered near 36°N, 18°W. The ***Sealand Achiever*** (37.7°N, 18°W) at 2100 ran into 37-knot easterlies in 5.5-meter (18 foot) seas. The rather large circulation of this system extended from Spain to the Cape Verde Islands. It remained near 35°N through the 31st.

Casualties—On the 10th, the mv ***Djarfago*** sank at Baia de San Pedro (Cape Verde) in bad weather with heavy swell. The crew made it safely to shore in a lifeboat assisted by local fishermen. On the 13th, the mv ***Maria*** off the Netherlands, near buoy TE-5, reported shifting cargo in 28- to 35-knot winds creating a 60° list. Five crew members abandoned vessel which was subsequently towed to Harlingen. On the 29th, a fierce rainstorm, strong winds and rough seas caused flooding and an overflow of rivers on the Portuguese island of Madeira. Eight people died and 10 fishing vessels sank.



*The **Galveston Bay** from LaHarve, France to Boston, Massachusetts ran into a Low near 45°N, 49°W on the 2nd of November.*

November—On the November climatic chart, the Icelandic Low begins to win the battle for supremacy of the North Atlantic from the Azores-Bermuda High. As was the case this year, the Azores-Bermuda High does not always surrender peaceably. The Icelandic Low joined the fracas as well and the result was large positive and negative anomalies as both climatic foes were more intense than normal. This usually spells trouble for vessels traversing the North Atlantic as pressure gradients become unusually tight which means winds are stronger. In addition, a huge, intense 1038-millibar high centered near St. Petersburg added to the tight pressure gradients over the North Sea and British Isles.

As would be expected from the pressure chart for the month in general, most of the cyclonic action occurred north of about 50°N and in particular in and around the Denmark Strait. The first real indication that this was going to be a November to remember appeared on the weather chart for the 9th when a double-centered 962- and 956-millibar Low was analyzed with the centers close to Iceland. At 0000 on the 9th, the ***CGDG*** (55.0°N, 53.0°W) measured force 10 (55 knot) north northeasterlies. At 0900 an excellent report was received by the ***VSBV3*** (52.7°N, 43.8°W). They encountered a 45-knot westerly in 7-meter (23 foot) seas. This storm weakened rapidly as it moved quickly northward. And this was simply a precursor of things to come.

A wicked storm intensified rapidly on the 14th near 55°N, 38°W. It was actually the combination of two rather innocuous Lows, one from the west and the other from the south. The result was one strong 967-millibar center, which plummeted to 944 millibars within 24 hours as it headed northeastward. The ***Sealand Performance*** on the 14th at 0600 near 45.7°N, 43.5°W battled 5.5-meter (18 foot) seas in 46-knot winds. Well east of the center on the 15th, winds in the 40- to 50-knot range were being reported by the ***Freja Svea***. The ***DBFJ*** (62.5°N, 30.4°W) at 1200 measured 40-knot southwesterlies in 7-meter (23 foot) seas. The system continued northeastward but split into several centers. Another storm joined the circulation to the south and on the 16th, it became the dominant center when its pressure dropped to 964 millibars near 58°N, 30°W. Unsettled conditions continued for several more days.

During the second half of the month, there was a flurry of activity on both sides of southern Greenland, but particularly at the southern side of the Denmark Strait. One of the few potent storms that occurred outside that area came to life on the 16th near the Grand Banks. By the 17th, it was heading toward the north northeast with a central pressure of 964 millibars. Fortunately, this intensity lasted for little more than a day before it was absorbed into another circulation north of Iceland.

On the 22nd a storm, which had come off Labrador with a 973-millibar center the day before, intensified to 952 milibars over the Labrador Sea. The closest ship report early on the 22nd came from the ***UFYN*** (57.3°N, 56.5°W); it measured 43-knot northerlies in 3.7-meter (12 foot) seas. This potent system moved into Baffin Bay where it stalled and weakened.

At 0000 on the 26th, a Low from the Grand Banks intensified to 949 millibars and trailed an active cold front about 1000 miles south of its center which was located just south of Kap Farvel. Vessels such as the ***Sealand Performance*** (46.7°N, 36.5°W) were reporting gales and 3.1- to 4.6-meter (10-15 foot) swells. There were also isolated reports of storm force winds on the 26th. For example, the ***Hual Ingrita*** (49.8°N, 46.4°W) in a hail shower encountered 58-knot westerlies in 8.5-meter (28 foot) seas. However, by the 28th the storm had weakened considerably. It was not quite finished. On the 29th and 30th, it reintensified near Iceland while a 962-millibar Low ventured into the Labrador Sea. These two systems were flanked to the south by a large 1034-millibar High resulting in gales or near gales along a good portion of the northern shipping lanes as testified to by the ***Oleander***, ***Jean Lykes***, ***OVYA***, ***OXYL*** and the ***Cumulus***.

Casualties– Two barge crew members died in the icy waters of eastern Lake Ontario on the 27th when the barge on which they were riding sank in 1.8- to 3.1-meter (6-10 foot) swells. That same day a tug skipper was killed when he and his crewman were tossed into the frigid surf during a storm off Long Island, New York. They were attempting to prevent a 94.5-meter (310 foot) heavy dredge barge loaded with 100,000 gallons of fuel oil from going ashore at Westhampton.

In England on the 14th, the mv ***Tern*** (50.6°N, 00.5°E) began taking on water into its holds in force 8 winds and rough seas. Two crew members were rescued by helicopter while the Master and two others attempted to beach the vessel. On the 21st, the mv ***Destiny*** sank 12 miles east northeast of Lerwick, England in near gale conditions. The crew members were rescued by the Lerwick lifeboat assisted by the support vessel ***Kommander Subsea***.

December–The Icelandic Low usually begins to exert its influence over the North Atlantic during this month. The Low is of course a reflection of the day-to-day winter storms that traverse the North Atlantic making life miserable for the mariner. The problem can be exacerbated when the normally weak Azores-Bermuda High is stronger than average, but the Icelandic Low was as much as 10 millibars deeper than normal at 992 millibars. The pressure gradient on the northern ship routes was intense on the mean pressure charts.

At the 500 millibar level, where steering patterns are often observed, the flow between 40°N and 60°N was directed toward the east northeast so that on average a storm off the Grand Banks would end up in the English Channel.

After a flurry of moderate cyclonic activity in the eastern North Atlantic during the first few days of the month, a wedge of high pressure took control from the eastern seaboard of the U.S. to the

Mediterranean. A front with several atmospheric waves caused a few minor problems off England on the 4th, but all in all the first 5 days looked promising. A short-lived 984-millibar Low came off the Delmarva Peninsula on the 5th and generated gale force winds between Cape Hatteras and Nova Scotia through the next few days. At 2100 on the 5th, the ***Sealand Shining Star*** (36.9°N, 72.0°W) ran into a 60-knot blow in 12.5-meter (41 foot) swells. This was associated with a trough south of the center. It was verified early on the 6th by the ***Export Freedom*** (3.7°N, 63.8°W) which hit a 60-knot westerly while battling 11.9-meter (39 foot) swells. The storm began to fizzle on the 7th.

Early on the 8th, a double-centered moderate Low was analyzed along the 45th parallel between 20°W and 30°W. The system deepened rapidly and moved toward Scotland as a 956-millibar Low. The first signs of the storm force potential of this system was received at 1200 from the ***Cape Hudson*** (47.0°N, 15.°W) which was blasted by 50-knot westerlies in 9.1-meter (30 foot) seas. Other vessels reporting included the ***Howell Lykes*** and ***Nosac Ranger***. Then at 1800 on the 8th, the ***Viva*** (49.7°N, 8.7°W) hit a 63-knot westerly in 23-foot seas. During the next 48 hours, the ***Viva*** kept forecasters apprised of conditions while battling 5.5- to 6.1-meter (18-20 foot) seas in winds ranging from 38 to 48 knots– a good job.

Also at 1200 on the 8th, station 62108 (53.2°, 15.0°N) registered a 55-knot westerly, a 976-millibar pressure and 9.5-meter (31 foot) seas. Most reports on the 8th were in the 40-to-50 knot range. At 1800 the ***LACU2*** (49.7°N, 8.7°W) reported a 63-knot westerly in 7.6-meter (25 foot) swells while the ***C6CY7*** hit 54-knot westerlies in 10.1-meter (33 foot) swells. By late on the 8th and early on the 9th, storm force winds were common. The storm raged throughout the 9th. At 0600 the ***DBFM*** (53.8°N, 7.4°E) ran into a 70-knot southwesterly and at 1200 station 62402 (53.7°N, 3.9°E) measured west winds at 65 knots and 6.1-meter (20 foot) seas.

Late on the 9th, the Low moved rapidly across Scotland and the North Sea. By the 10th, it was safely (for mariners) inland.

A 988-millibar Low developed along a front on the 12th east of the Outer Banks of North Carolina. This short-lived storm generated gale and strong gale conditions for the next couple of days as it meandered eastward. Reports were received from such top ships as the ***Charlotte Lykes***, ***Tabasco, Newark Bay*** and the ***Oleander***.

On the 14th at 1800, the ***Oleander*** (32.7°N, 64.8°W) ran into 35-knot winds while battling 7.6-meter (25 foot) swells. The ***Tabasco*** transmitted several reports of gale and strong gale conditions while the ***Newark Bay*** (37.8°N, 69.8°W) encountered 37-knot northwesterlies in 4.6-meter (15 foot) swells.

This Scottish gale developed over New York State on the 11th. It made its way to southern Greenland by the 13th where it was a respectable 971-millibar Low. However, during the next 24 hours its central pressure dipped to 955 millibars and held near that intensity as it approached the Outer Hebrides on the 15th, a wicked storm if the truth be known. Its effect on shipping were felt as far south as the Bay of Biscay and north into the Barents Sea. At 1800 on the 14th, the ***Tillie Lykes*** (49.8°N, 3.9°W) hit 44-knot south southwesterlies. The ***Cumulus*** (57.5°N, 23.5°W) manning the British Ocean Weather Station J battled storm force winds throughout the 14th and into the following day. Typical was their 1800 report on the 14th when they measured 55-knot winds in 9.1-meter (30 foot) swells and 7.0-meter (23 foot) seas with a 981-millibar pressure. What a detail.

A large High settled in, centered between the Azores and Spain, and covered a good portion of the eastern North Atlantic for most of the second half of the month. This forced many Lows through the Denmark Strait.

One of the most intense extratropical storms of the year intensified during this period. Fortunately, it was centered near 70°N at the time. The Low developed out of a complex low pressure system on the 18th south of Iceland. It contained two centers– one at 962 millibars and the other at 965 millibars. The storm swung northeastward to the east of Iceland and organized into one potent 950-millibar center at 0000 on the 19th. This in itself was a potent storm, but the system continued to intensify and by 0000 on the 20th, its central pressure had plummeted to 938 millibars. Its influence extended from the east coast of Greenland to the Baltic Sea and south to the North Sea. At 1200 on the 20th, the ***Tyson Lykes*** (47.7°N, 18.0W°) ran into a westerly 56-knot wind while battling 7.6-meter (25 foot) seas. The ***Nosac Ranger*** was reporting gale

force winds in 3.1- to 5.2-meter (10-17 foot) swells even though they were at about 43°N. Both these reports were actually associated with a smaller Low roaming the 50°N parallel but whose pressure gradients were significantly enhanced by the monster to the north. While the storm was not severely impacting the major shipping lanes traffic, fisherman and platforms in the Greenland and Norwegian Seas were under a state of siege on the 20th. At 0200 on the 20th, the ***DBFZ*** (54.6°N, 11.8°) was battered by 59-knot (force 11) westerlies. Station 63111 (59.5°N, 1.5°E) measured 44-knot (force 9) winds in 9.1-meter (30 foot) seas. Condition improved somewhat on the 21st as the 950-millibar center moved north of 70°N.

Toward the end of the month, there was a flurry of extratropical activity between Nova Scotia and Iceland. On the 22nd, a 970-millibar Low crossed the St. Lawrence River near its month and moved north northeastward into the Labrador Sea. Then came the tale of three potent storms that all ended up near the entrance to the Denmark Strait on the last 4 days of the month. Within 2 days of each other, a pair of storms came to life east of the Outer Banks of North Carolina. The first developed on the 23rd and both took a northeastward track across the Grand Banks. Meanwhile on the 26th, another Low developed near 43°N, 45°W and headed toward the Denmark Strait. The first system peaked at about 962 millibars on the 25th south of Kap Farel. When it reached the southern entrance to the Denmark Strait, it slowed, weakened and began a counterclockwise loop. By this time the second system was intensifying. At 1200 on the 28th, its central pressure was at 958-millibars and then was down to 946 millibars 12 hours later. By this time, the third storm was turning a counterclockwise loop near 60°N, 30°W and its central pressure dipped to 952 millibar at 1200 on the 28th. It then merged with storm number two. Storm force winds were plentiful on the 29th as far south as 45°N while gales extended to 40°N mostly south of storm number two's center. At 1800 on the 28th, the ***LXAP*** (48.0°N, 25.5°W) hit 60-knot (force 11) west southwesterlies in 6.1-meter (20 foot) swells. The ***DEOF*** (64.4°N, 35.2°N) at 1500 that same day reported 64-knot (force 12) northeasterlies and a 965-millibar pressure not too far from the center. The ***LAFQ4*** (49.5 N, 22.2 W) at 1200 on the 29th battled 11.9-meter (39 foot) swells in force 10 winds. The slow moving complex system hung around and dominated weather through the end of the month.

Casualties—On the 2nd, Bulgarian naval officers found the mv ***Volga-Balt 38*** washed up on a beach with no signs of crew or survivors some 600 miles north of Cape Shabal on the Black Sea. It was feared that a storm had caused the disaster as bad weather has persisted in the region for several days.

On the 9th, Wales was battered by winds up to 78 knots. Marine problems included the mfv ***Morning Sun*** (engine trouble), the trawler ***Dunboy*** (loss of power steering) and the chemical tanker ***Grape One*** which developed a 60 degree list to port in force 8-9 winds and rough seas. The crew of 15 abandoned ship and was rescued. The container ship ***Sherbro*** reported losing 50 containers on the 9th near 49°7 N, 3.5°W. Later, half a ton of toxic pesticide packets lost by the ***Sherbro*** washed up on a Normandy beach. The pesticides were packed in the containers and hermetically sealed in aluminum. The ***Lars Maersk*** reported three containers overboard, and the mv ***Lonza*** lost an unspecified number of containers in the same storm.

Late in the month, the worst flooding in 60 years hit Europe, swamping riverside cities in the Netherlands, eastern France and Germany. Many people were forced to evacuate their homes and spend the holidays in Army barracks or hotels. At least five people died in the storm as gale-whipped floods surged through low-lying areas.

Two New York men were rescued with assistance from the U.S. Coast Guard when their 9.1-meter (30 foot) sloop ***Lightfoot*** bound for Bermuda sank in reported 80-knot winds and 12.2-meter (40 foot) seas 275 miles southwest of Cape Cod on the 11th. The Japanese freighter ***Shin Kakogawa Maru*** bound for Ireland voluntarily diverted approximately 10 hours from its course to perform a textbook deep-draft ship handling procedure to rescue two men.

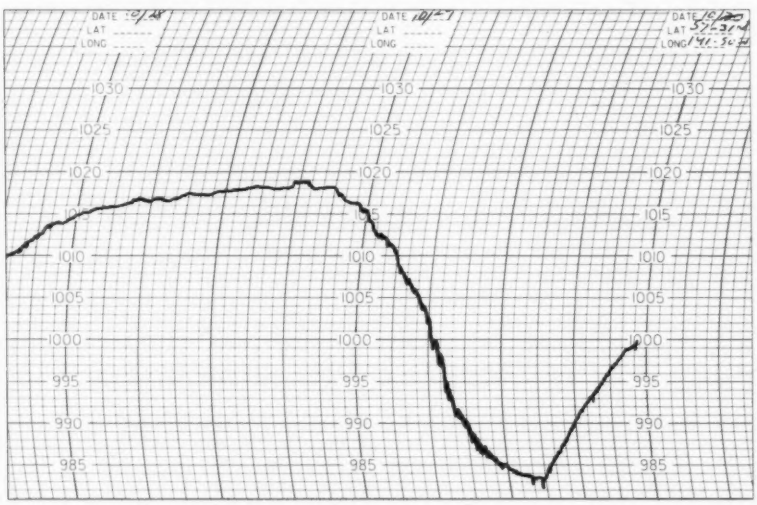
On the 20th, three commercial fishermen were rescued through the efforts of the Canadian and U.S. Coast Guard when their 27.4-meter (90 foot) fishing boat ***Aaron & Melissa*** sank in winter waters south of Nova Scotia.

North Pacific Weather
October, November and December 1993

October–The Bering Sea was where the Aleutian Low operated this October– it is usually centered near the Gulf of Alaska. The result was negative anomalies down to -6 millibars east of the Kamchatka Peninsula. Pressures were slightly higher than normal in the Gulf of Alaska and the subtropical high was somewhat deeper than normal near the dateline. At 500 millibars this surface anomaly resulted in a trough with an axis extending from the northwestern Bering Sea southeastward into the eastern North Pacific Ocean.

Not only was the Aleutian Low displaced, but it was quite extensive reflecting a cyclonically active October. During the first half of the month, the two storms that stood out were former Typhoon Ed and a 962-millibar Low which hit the Alaska Peninsula.

The month opened with a 963-millibar Low aggravating mariners in the Gulf of Alaska and northeastern North Pacific with gale force winds and 4.6 to 6.1-meter (15-20 foot) swells. Such ships as the ***President Adams, Prince of Tokyo*** and ***Luna Maersk*** reported in. This system fizzled rather quickly, but by the 4th Typhoons Ed and Flo were making their presence felt in the Philippine Sea. To the north, a Low was beginning to develop along a front east of northern Honshu. On the 6th its central pressure was 1006 millibars, and by 1200 on the 8th it had plummeted to 967 millibars as it sped toward the north northeast. The ***Green Suma*** (41.1°N, 171.3°W) measured 41-knot east southeasterlies in 5.1-meter (17 foot) swells. The system began to weaken as it approached the Alaska Peninsula the following day. However, by this time former Typhoon Ed had turned extratropical and was beginning to intensify as it headed toward the Aleutians. By the 10th after crossing 45°N near 175°E, its central pressure dipped to 966 millibars. At 0600 on the 10th, the ***Santorin 2*** (41.1°N, 177.5°E) ran into 46-knot south southeasterlies in 7.9-meter (26 foot) seas. They also measured a 988-millibar pressure. Other vessels in the vicinity such as the ***Laust Maersk***, ***California Triton*** and ***Bosporus Bridge*** were reporting force 8 winds in

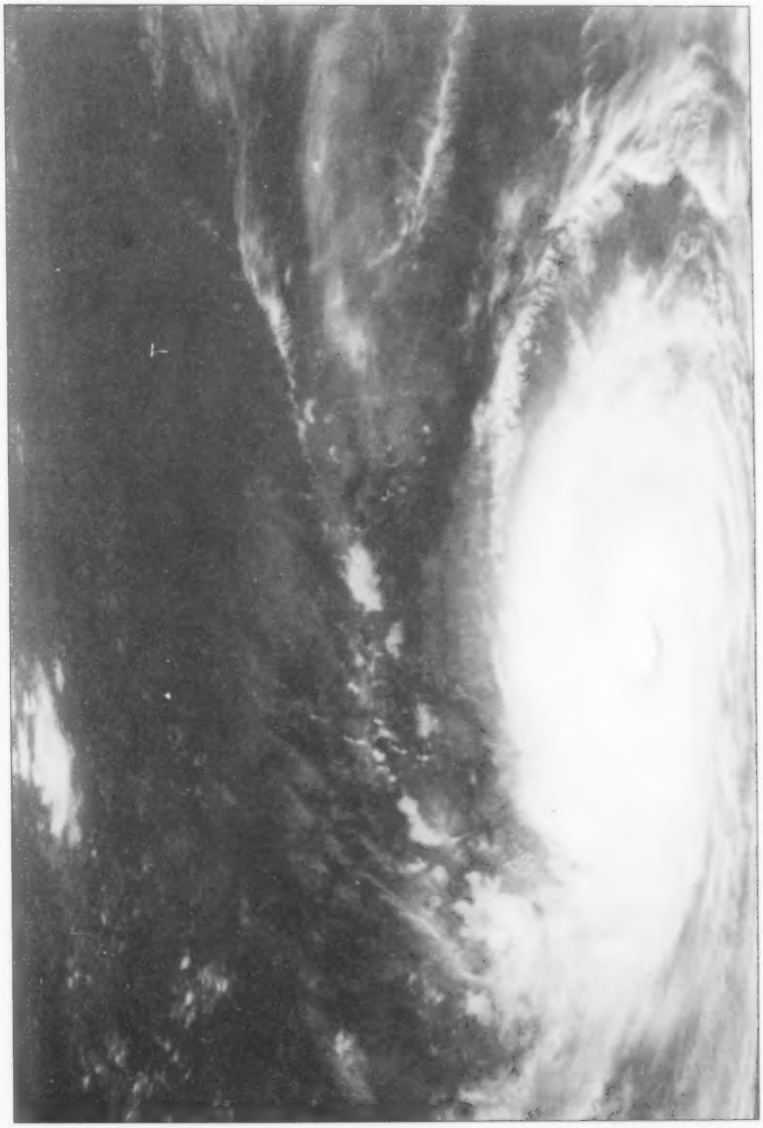


*The **Overseas New York** was on a voyage from Long Beach, California to Valdez, Alaska when it ran into a low pressure system on the 29th of October.*

4.8- to 6.0-meter (16-20 foot) swells. These conditions persisted into the 14th as the storm moved into the Bering Sea. It weakened rapidly once across Nunivak Island and on to the Alaskan mainland on the 12th.

Two second half of the month storms made an impact on the weather, particularly over the northern shipping lanes. On the 17th, a low pressure system was analyzed off Sakhalin in the Sea of Okhotsk. Moving east northeastward then eastward along the 55th parallel, the system intensified. Once across the Kamchatka Peninsula, its central pressure was analyzed at 980 millibars on the 19th. Ships particularly south of the center encountered gales and 5-meter seas (16 foot). The ***Sealand Express*** (49.0°N, 1612.0°E) at 0000 on the 19th reported 48-knot west southwesterlies in 5.1-meter (17 foot) seas. The storm filled slightly as it hugged the 55th parallel on the 20th. Once across the Alaska Peninsula, it dipped toward the southeast and then swung northeastward on the 21st. During this period, it reintensififed and by the 22nd central pressure was down to 968 millibars and dominating weather in the Gulf of Alaska. At 1200 on the 22nd, the ***Baltimore Trader*** (50.4°N, 139.7°W) encountered 50-knot westerlies in 7.9-meter (26 foot) seas while 12 hours earlier the ***Blue Ridge*** (51.3°N, 139.7°W) measured 42-knot winds in 6.0-meter (20 foot) seas. Fortunately, the storm began to weaken as it approached the Alexander Archipelago.

On the 23rd, a Low developed off northern Honshu and headed northeastward. It deepened rapidly, and by the time it entered the Sea of Okhotsk the following day, it sported an 874-millibar center. On the 26th, it emerged from the Kamchatka Peninsula with a 968-millibar central pressure. The system dominated a good portion of the northwestern North Pacific. Vessels such as



Satellite Data Services Division

Typhoon Ira dominated the weather over the Philippine Sea as the month of October came to a close. This NOAA 12 shot was taken on the 31st of October 1993.

the ***Sealand Explorer***, ***President Jackson***, ***Prince of Tokyo 2*** and ***Polar Alaska*** (53.6°N, 177.9°E) reported a force 9 (46-knot) wind. The system was most potent on the 26th but continued to influence weather along the northern shipping routes through the 28th as it moved eastward across the Bering Sea. The month came to a close with Typhoon Ira terrorizing the Philippine Sea.

Casualties—Thirty-eight passengers and the crew of the 36-meter (118 foot) ferry ***Mani Princess*** were rescued after the vessel went aground on a reef in Hawaiian waters in a blinding rainstorm on the 26th. On the 4th, the mv ***Eastern Glory*** sank in heavy weather near 26.2°N, 121.3°E. A lifeboat was found carrying five crew members, but another nine were missing. The ***St. Edward*** and ***Diamond City*** were driven aground at North Harbor in Manila during Typhoon Flo.

On the 10th, the ***Seohae Ferry***, a 110-ton South Korean passenger ferry packed with holiday-makers, fishermen and islanders, capsized in rough seas off the west coast of South Korea some 220 kilometers south of Seoul. More than 286 people were feared drowned while 70 were plucked to safety. The vessel was licensed to carry 206 passengers.

November—The Aleutian Low is usually the dominant climatic feature over the North Pacific in November. The Low is easily recognizable on this November's mean pressure chart but instead of stretching from Kamchatka to the Gulf of Alaska, it centered in the Bering Sea and extended southward. The eastern North Pacific subtropical high remained in place and its influence extended toward the Gulf of Alaska resulting in a large area of positive 8 to 12 millibar anomalies in the region. The surface patterns were reflected aloft although the 500 millibar picture showed a mostly zonal flow west of the dateline. To the east, the flow was turned toward the east northeast.

The month began with a large 970-millibar Low moving across the Kamchatka Peninsula. Its gradient was strong enough to generate gales out to 500 miles south of its center. The ***OOCL Explorer*** at 0000 on the 1st near 54°N, 170°E ran into 42-knot winds in 5.1-meter (17 foot) swells while the ***Sealand Developer*** (45.6°N, 163.2°E) battled 7.0-meter (23 foot) swells in 40-knot southerlies. By the 4th the gradient had slackened considerably. A series of weak to moderate Lows occupied the North Pacific north of 40°N for the next few days. On the 3rd at 0600, the ***Sealand Voyager*** (47.9°N, 161.5°E) ran into one of these moderate systems and reported 50-knot westerlies in 5.5-meter (18 foot) swells.

On the 8th, a 972-millibar Low was analyzed near 54°N just east of the dateline. The following day it merged with another system into a potent 954-millibar Low over the central Bering Sea. At 1800 on the 9th, the ***President Jackson*** (53.6°N, 153.8°W) encountered 40-knot south southwesterlies in 2.4-meter (8 foot) swells, which increased to 4.6-meters (15 foot) 12 hours later. While this system began to fill on the 10th, another which had formed in its wake intensified. By the 11th its 964-millibar center crossed the 55th parallel near 175°W. The ***Sealand Explorer*** (52.5°N, 176.6°W) reported a 975-millibar pressure with 43-knot southerlies in 6.4-meter (21 foot) swells at 0500 on the 11th. One hour later winds were measured at 63 knots, swells were up to 7.9 meters (26 foot) and visibility was at 1 mile in continuous moderate rain. Nearby, the ***President Jackson*** ran into 56-knot south southwesterlies in 6.0-meter (20 foot) swells. The vessels were within 200 miles south of the center. The storm system weakened as it made its way northeastward to the Alaska mainland on the 13th.

While several moderate Lows developed and traversed the Pacific during the mid part of the month, it wasn't until the 25th that an intense storm generated widespread gales. This 966-millibar Low was heading east northeastward in the western Bering Sea. Along the northern North Pacific shipping lane gales were being reported by vessels such as the ***OOCL Explorer*** (49.0°N, 156.3°W), the ***Polar Eagle*** (53.8°N, 178.3°W and the ***Polar Alaska*** (45.9°N, 154.1°E). Swells were running from 3.0 meters to 6.0 meters (10-20 foot). These conditions persisted through the 26th as the storm tracked slowly toward the east northeast and began to weaken.

While the previous storm was dissipating, another Low paralleling the eastern Aleutians was gathering steam. On the 28th at 1200, its central pressure was estimated at 982 millibars, while 24

hours later off the Alaska Peninsula pressure was down to 964 millibars. It was generating gales and 4.6- to 6.0-meter (15-20) foot swells. The center was actually part of a complex multi-centered Low that dominated the northern North Pacific and Gulf of Alaska for the last 3 days of the month. West of the dateline, vessels like the ***Sealand Defender, Sealand Voyager, McKinney Maersk, President Jackson and President Hoover*** ran into strong winds and rough seas. The ***President Hoover*** (45.9°N, 165.3°E) ran into 54-knot westerlies in 7.6-meter (25 foot) seas at 0600 on the 29th. On the 30th, the ***Santorin 2*** (44.9°N, 163.2°W) measured 61-knot west southwesterlies in 5.5-meter (18 foot) swells at 0300 on the 30th. They also measured at 976-millibar pressure. November roared out like a lion in these waters.

Casualties—As Typhoon Ira lashed the Philippines on the 2nd, a motor launch overturned off Launang Island drowning six people and leaving 63 survivors. On the 10th, the ***Tropic Wind*** sank during Tropical storm Jean about 20 miles north of Kita Shima. The crew abandoned the vessel and were rescued by the bulk carrier ***Hyuga***. On the 27th, the mv ***Dasa Tujuh*** with a cargo of logs sank some 350 miles east southeast of Hong Kong after developing a 15 degree list in rough seas. Of the crew 19 were saved by four vessels that had rushed to the scene. Some eight crew members were missing.

December—The Aleutian Low was a significant feature on the mean sea level pressure chart. Its center was deeper and somewhat east of its normal position so a large area of -4 to -6 millibar anomalies was located over the Gulf of Alaska and eastern Bering Sea. The 500-millibar upper air chart showed that steering currents were nearly zonal, following the latitude lines. However, east of 165°W the currents turned toward the northeast. While a few storms moved zonally, most headed toward the east northeast and northeast with a definite concentration of activity in the Gulf of Alaska and eastern Bering Sea. It was a ferocious month.

On the 3rd, a 968-millibar Low lurked over the Kamchatka Peninsula while Tropical Storm Lola was intensifying in the Philippine Sea. By the 5th Lola was a typhoon, Topical Storm Manny was following in its wake and the Kamchatka Low was charging across the northern Bering Sea. Its circulation along with a secondary center was large enough to trigger gales as far south as 40°N. The first blockbuster of a storm began intensifying in the midPacific on the 8th as Typhoon Manny approached northern Luzon.

This storm can be traced back to the 5th but was rather innocuous until it crossed the dateline on the 8th near 43°N. It deepened very quickly after that. By 1200 on the 9th, its central pressure had dipped to 958 millibars, and it was beginning to recurve toward the Queen Charlotte Islands. At 0300, the NOAA ship ***Discoverer*** (39.2°N, 137.1°W) sent in a report of 37-knot south southwesterlies in 3.9-meter (13 foot) swells. In general, winds were running about force 9 closer to the center. At 1800 on the 9th, the ***Sealand Anchorage*** (49.2°N, 126.9°W) estimated winds at 60 knots (force 11) in a violent rain shower with 4.6-meter (15 foot) seas. Nearby the ***Arco Fairbanks*** recorded 35-knots. And the ***Ferncroft*** was rolling in 7.9-meter (26 foot) swells in 40-knot (force 9) southerlies. The storm went ashore as a 962-millibar Low on the 10th.

This Tokyo Low deepened from 1008 millibars at 1200 on the 8th to 955 millibars by 1200 on the 10th— a drop of 63 millibars in 48 hours. The ***Georgia*** sent in several good reports during this storm. At 0600 on the 10th near 47.6°N, 176.4°E, they encountered a 45-knot easterly with visibility reduced to 50 yards in heavy rain. At the time they were battling 5.1-meter (17 foot) swells and recorded a 982-millibar pressure. The storm moved along the 50th parallel on the 11th and then began to recurve toward the Queen Charlotte Islands the following day.

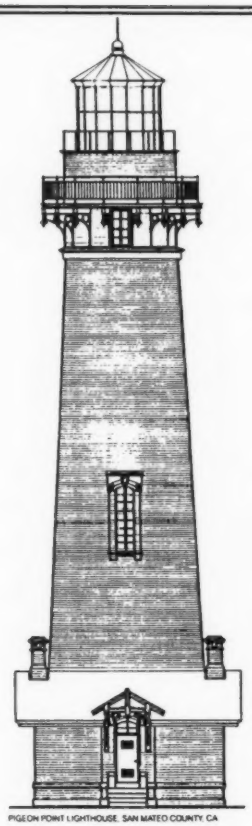
By this time a Low from Honshu was kicking up its heels as a 973-millibar center near 45°N, 165°E. On the 13th its central pressure dipped to 967 millibars over the central Aleutians. The ***Luna Maersk*** (52.0°N, 168.3°E) with continuous heavy snow reducing visibility to 50 yards was blasted by a 58-knot northeasterly in 10-meter (33 foot) swells at 0000 on the 13th. In general, winds were running in the force 8 and force 9 range. The Low moved right along the Aleutian Chain and up the Alaska Peninsula on the

15th.

During the early part of the second half of December, a couple of moderate storms affected mariners traversing the northern shipping lanes, but on the 23rd a real beauty sprung to life. This Low formed along a front east of Honshu on the 22nd. It actually took control and the following day was a 968-millibar storm heading east northeastward. It crossed the dateline on the 24th near 50°N and that's when the fun began. For the next 5 days, it turned a counterclockwise loop then made a clockwise turn and by the 29th was not far from its original position when it entered the Aleutians. What was not funny, however, was that it remained a potent storm throughout all these gyrations. So it was basically a bad weather week over the Aleutians and along the shipping lanes south to about 40°N. On the 26th at 0300, the ***Santorin 2*** (52.7°N, 179.4°E) recorded a 963-millibar pressure in rain showers. At the time, they were battling 42-knot northwesterlies in 6.0-meter (20 foot) swells. Winds of force 8 and force 9 were common while seas were generally running 4.6 to 6.0 meters (15-20 foot).

The last storm of the month developed on the 28th out of a complex morass of atmospheric waves along a front near mid ocean. By the 29th its pressure fell to 968 millibars and at 1200 on the 30th it was down to 952 millibars with a center near 45°N, 165°W. At 0000 on the 31st, the ***OOCL Explorer*** (52.0°N, 163.6°W) hit 50-knot winds (force 10) while the ***President Lincoln*** (39.2°N, 165.4°W) battled 9.1-meter (30 foot) swells to the south. At 1800 the ***OOCL Explorer*** again reported storm force winds in 4.8-meter (16 foot) seas with a 977-millibar pressure. On the last day of the month, the ***Westwood Belinda*** (42.5°N, 165.2°W) ran into a 50-knot westerly in 10.6-meter (35 foot) seas. The old year roared to a close in the Pacific.

Casualties—Research vessel ***Kvarts*** ran aground during a blizzard and was stranded on a rock in the strait between Hokkaido and Sakhalin Island. All 18 crew members were rescued. Typhoon Lola was responsible for an estimated $50 million (U.S.) damage on Luzon along with at least 230 deaths. It then went on to raise havoc in Vietnam. The ***OOCL Award*** suffered heavy weather damage on the 8th. Typhoon Manny also hit the Philippines leaving at least 70 people dead and $20 million (U.S.) in damages. Manny devastated the same area as Lola. The mv ***Southern Glory*** sank on the 10th in heavy weather on a voyage from Muara Port to Singapore. All crew members were rescued. The vehicle carrier ***Diamond Highway***, Hiroshima for Mizushima and carrying 766 Mazda cars, ran aground off Sakaide in strong winds on the 23rd. The vessel was subsequently refloated. The ***Kiowa***, a general cargo vessel, sank in the Mindanao area of the Philippines on the 26th during Typhoon Nell. In the same storm, the ro-ro ferry ***Asia Indonesia*** ran aground at Cebu while the yacht ***Queen Mary*** sank at Cebu. Nell swept across the central Philippines leaving at lest 52 people dead and more than 14 vessels sunk.


PIGEON POINT LIGHTHOUSE, SAN MATEO COUNTY, CA

PRESERVATION
PLAN ON IT

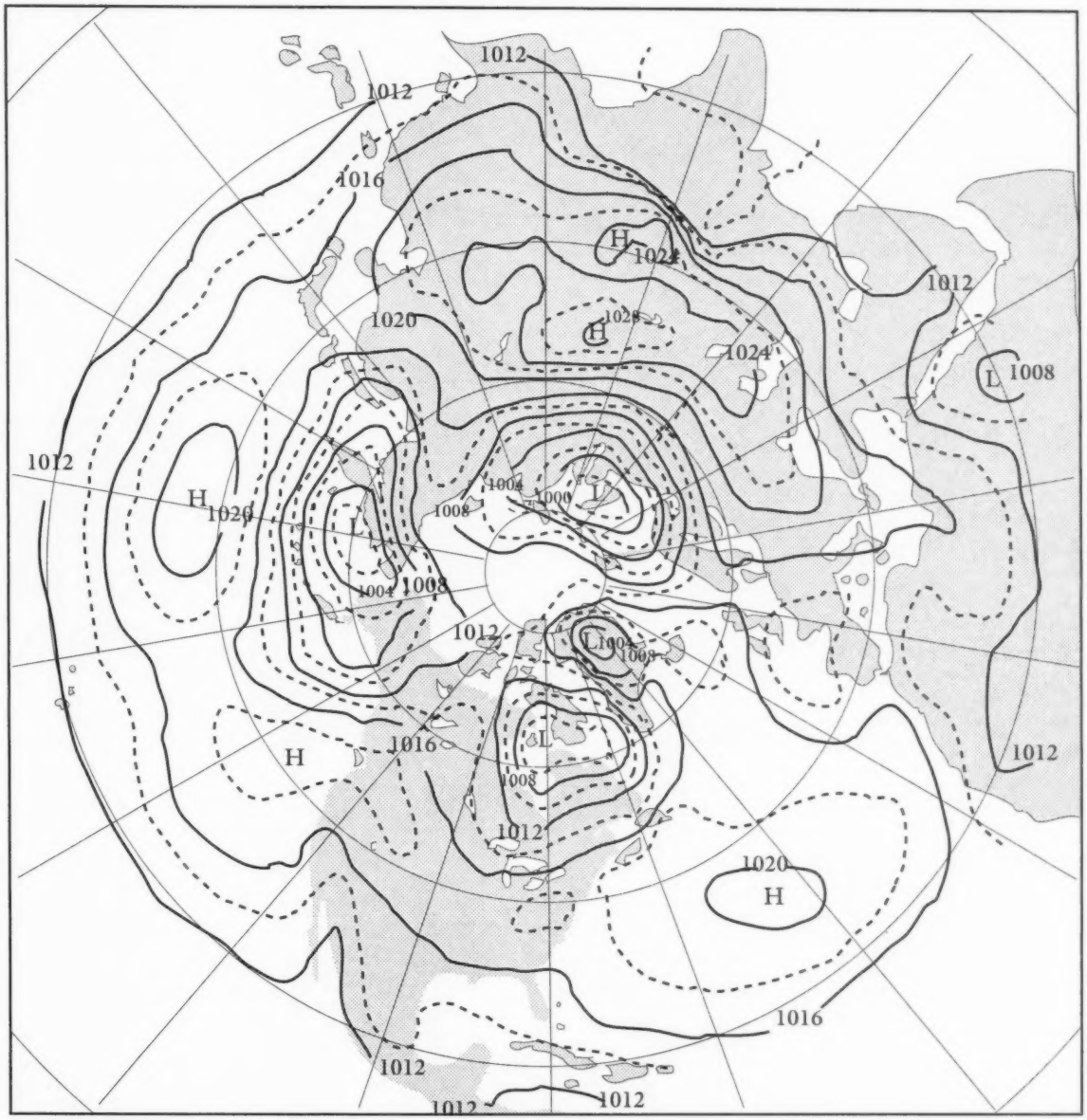
Planning on restoring a house, saving a landmark, reviving your neighborhood?

Gain a wealth of experience and help preserve our historic and architectural heritage. Join the National Trust for Historic Preservation.

Make preservation a blueprint for the future.

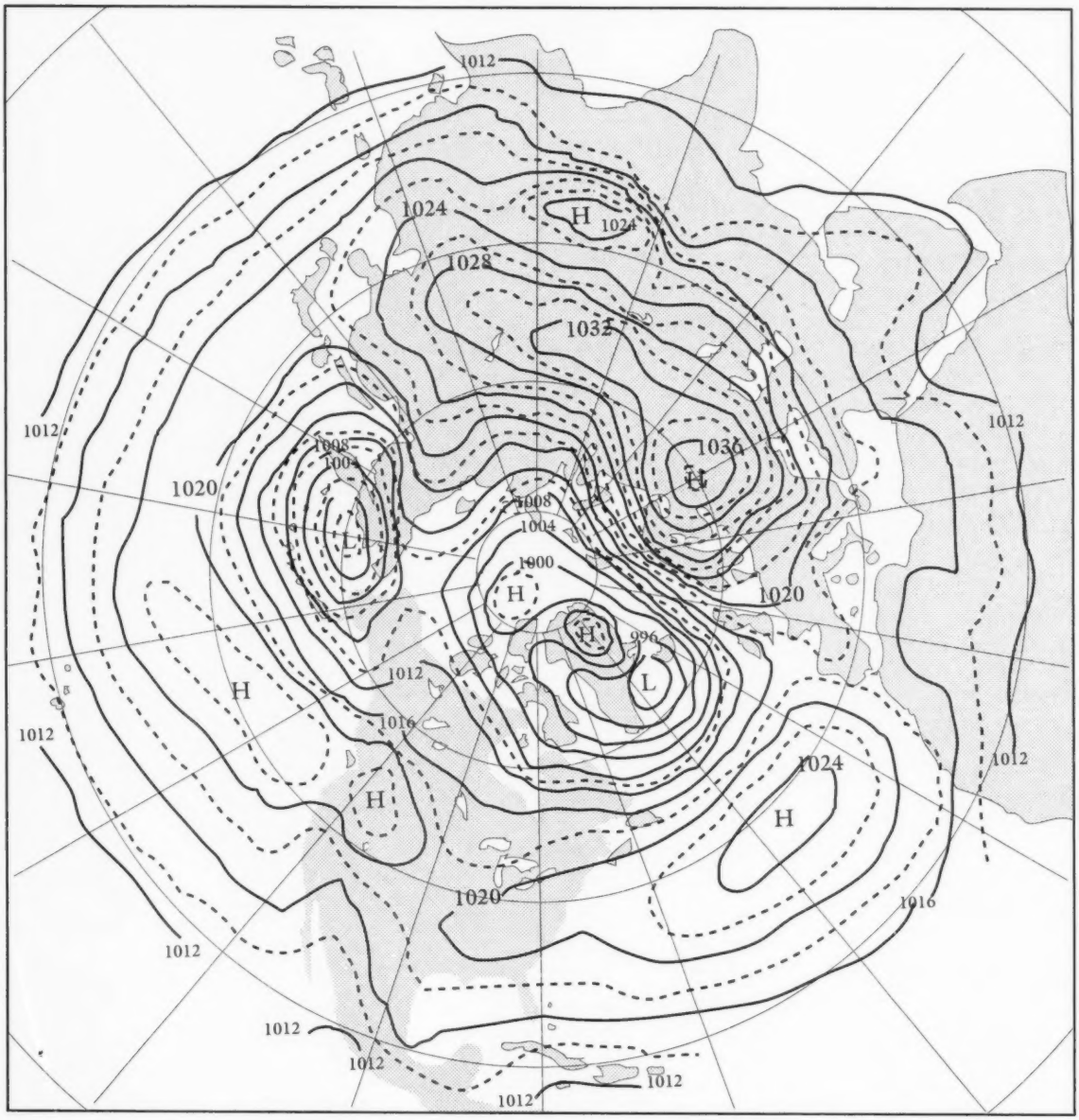
Write:
National Trust
for Historic Preservation
Department PA
1785 Massachusetts Ave., N.W.
Washington, D.C. 20036

October 1993



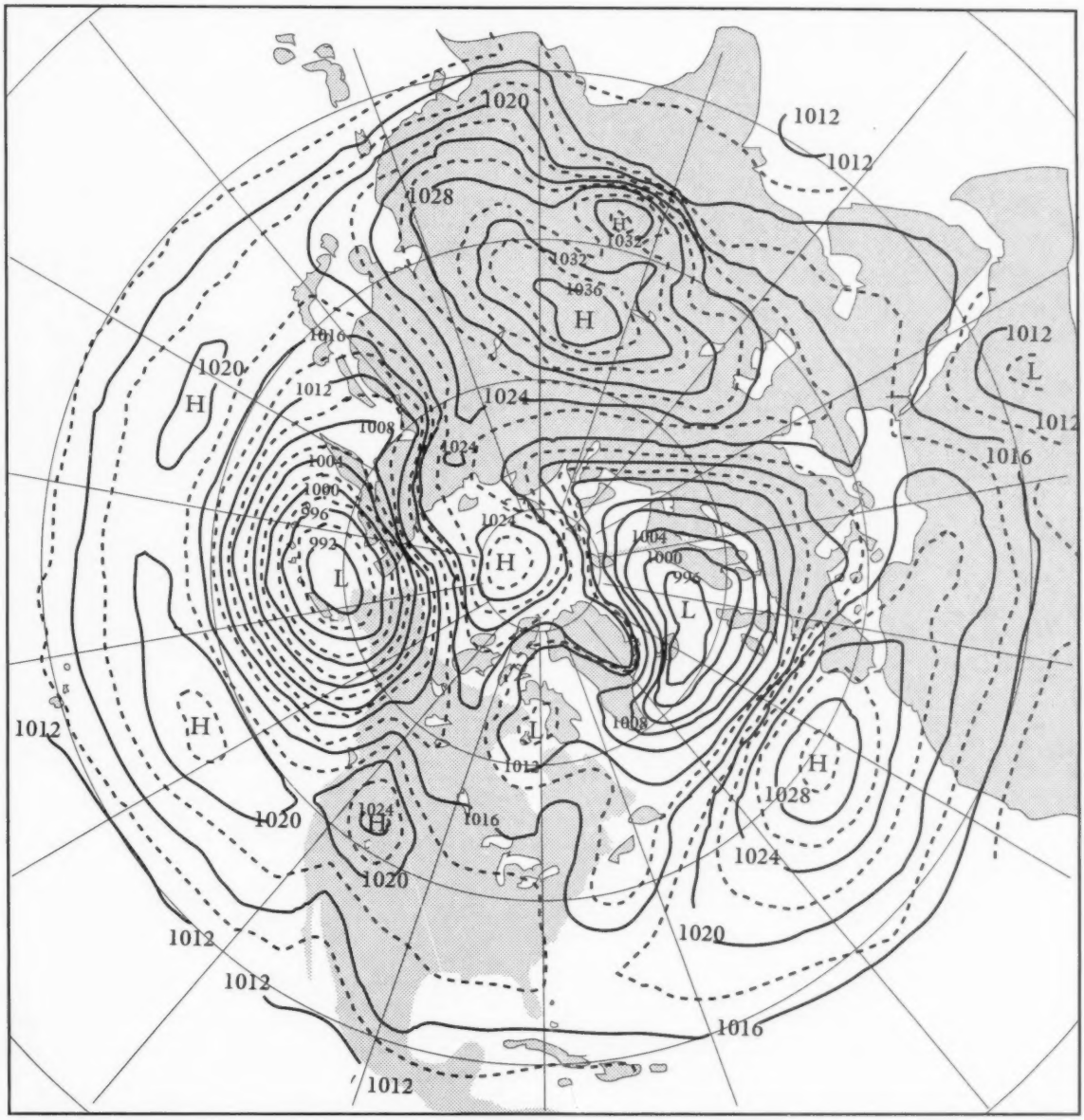
These Charts were provided by John Kopman and Vernon Kousky of the Climate Analysis Center from the Climate Diagnostics Bulletin

November 1993



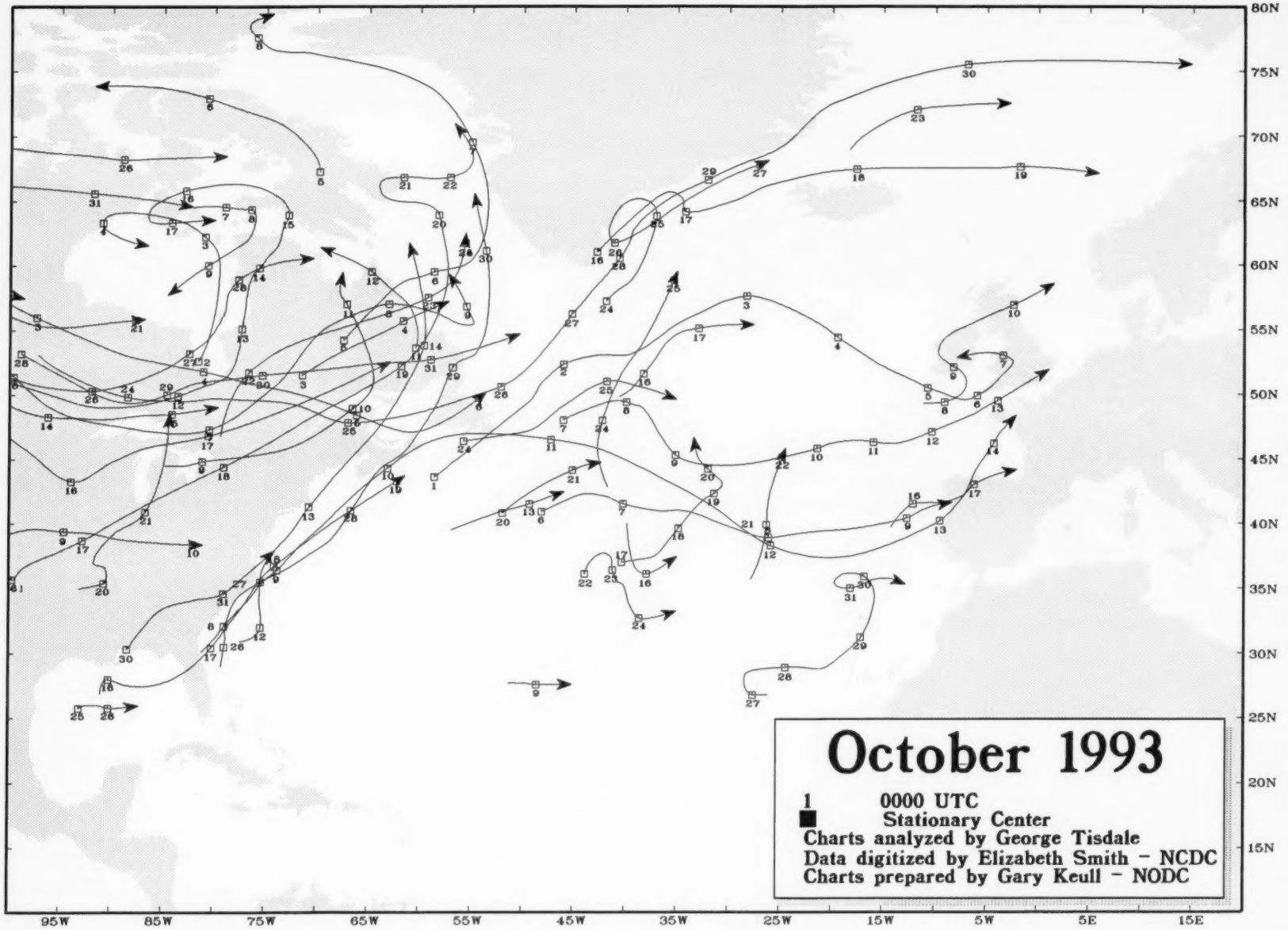
These Charts were provided by John Kopman and Vernon Kousky of the Climate Analysis Center from the Climate Diagnostics Bulletin

December 1993

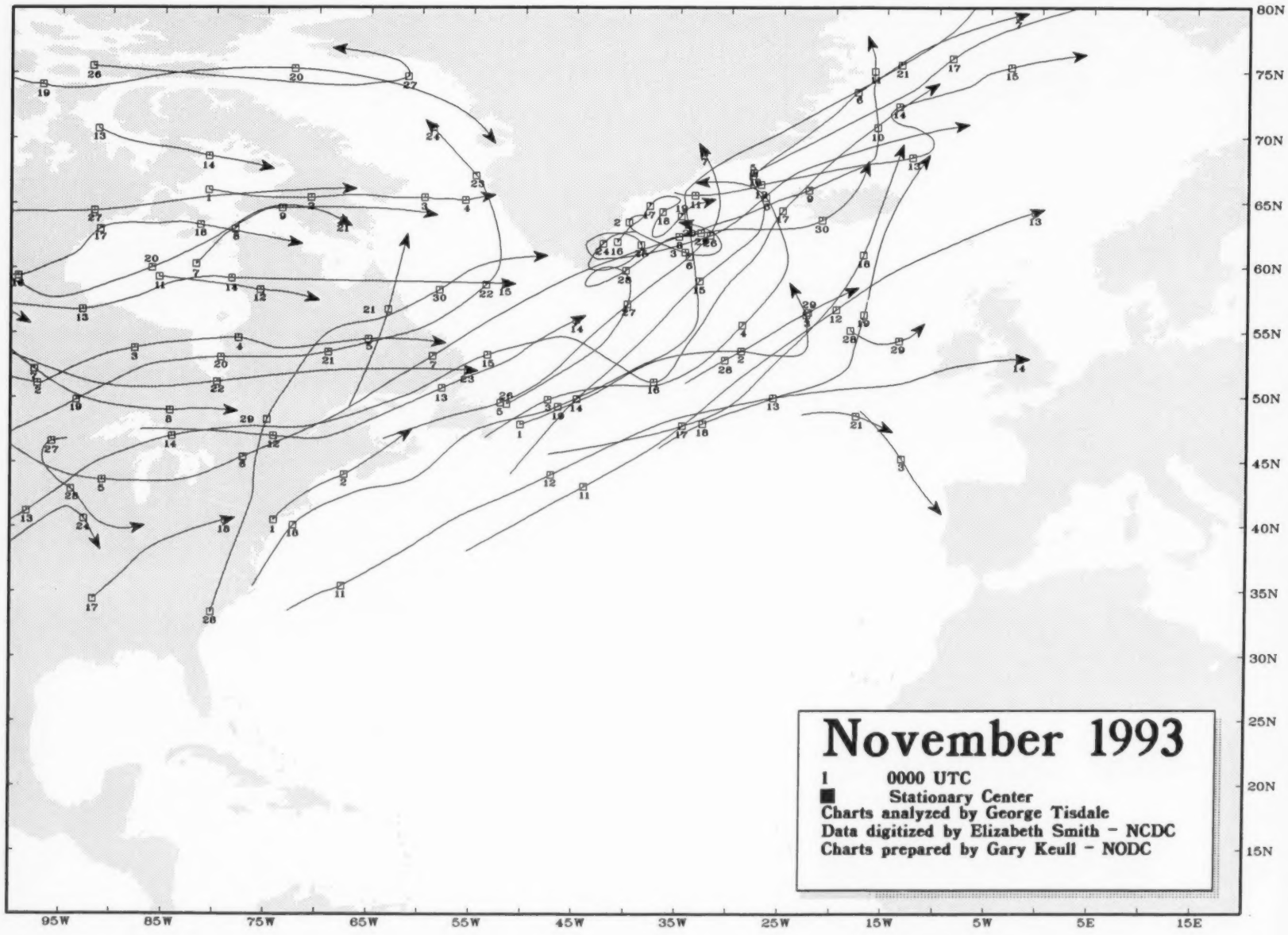


These Charts were provided by John Kopman and Vernon Kousky of the Climate Analysis Center from the Climate Diagnostics Bulletin

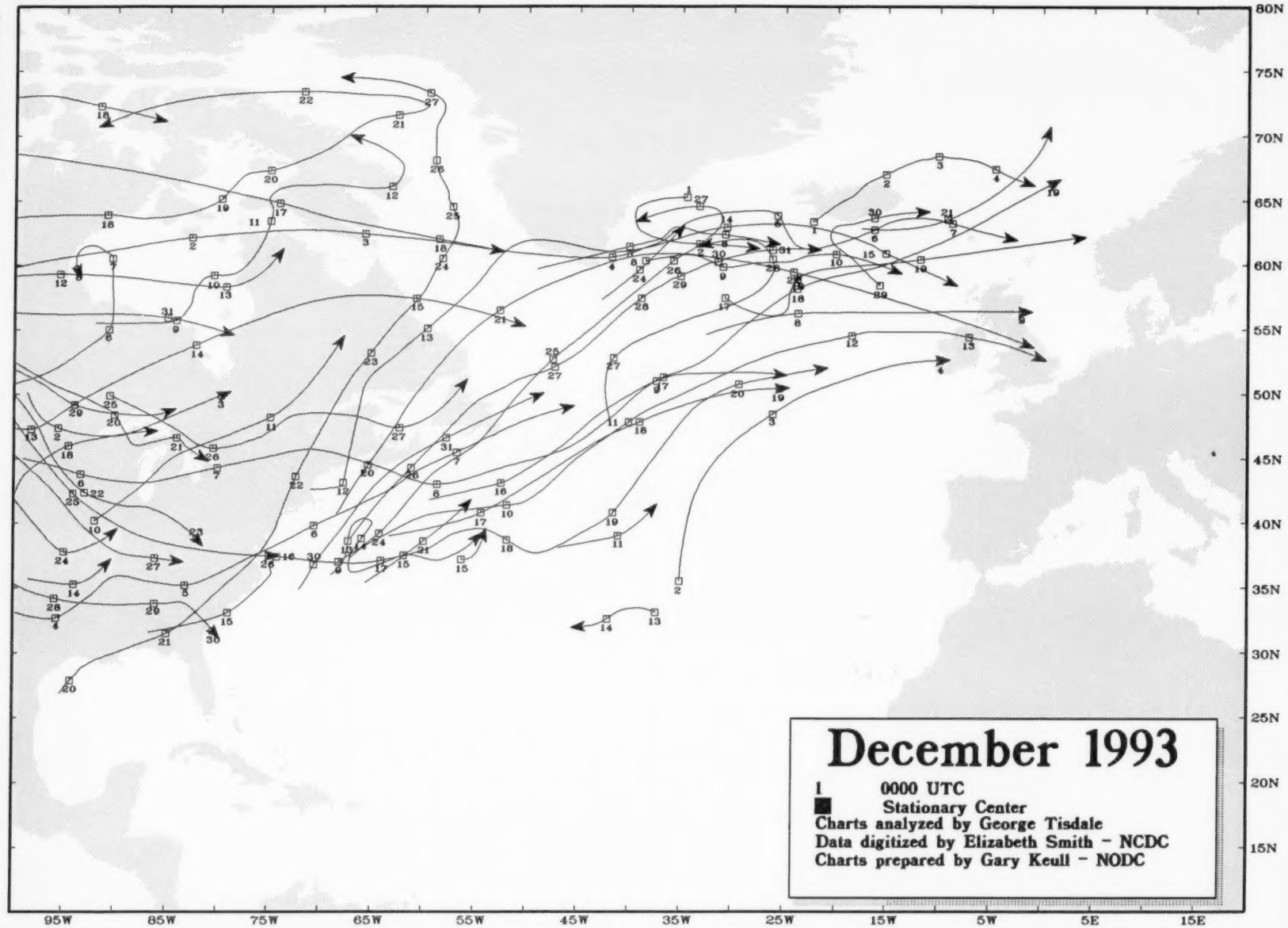
Principal Tracks of Cyclone Centers at Sea Level, North Atlantic

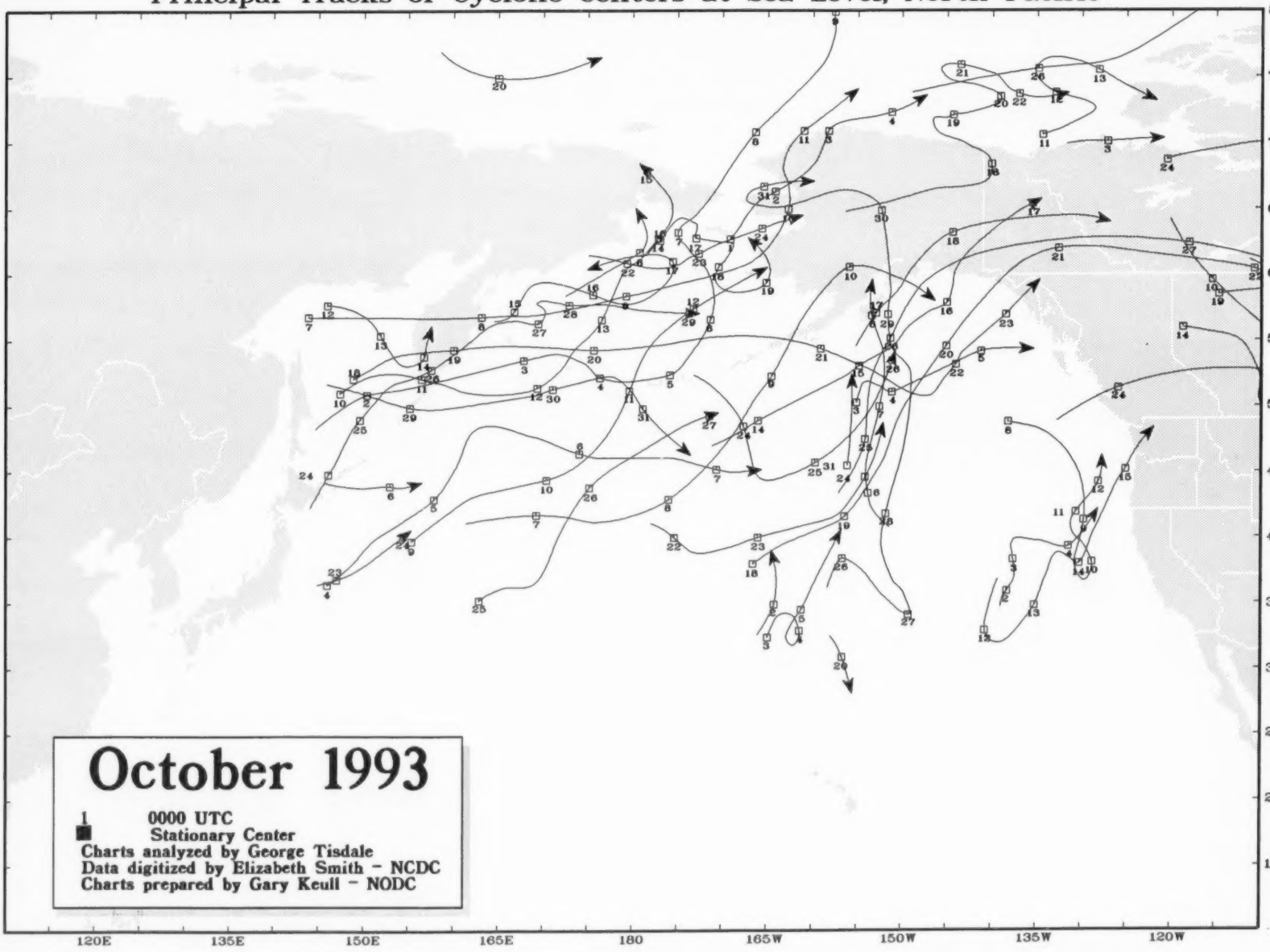


Principal Tracks of Cyclone Centers at Sea Level, North Atlantic

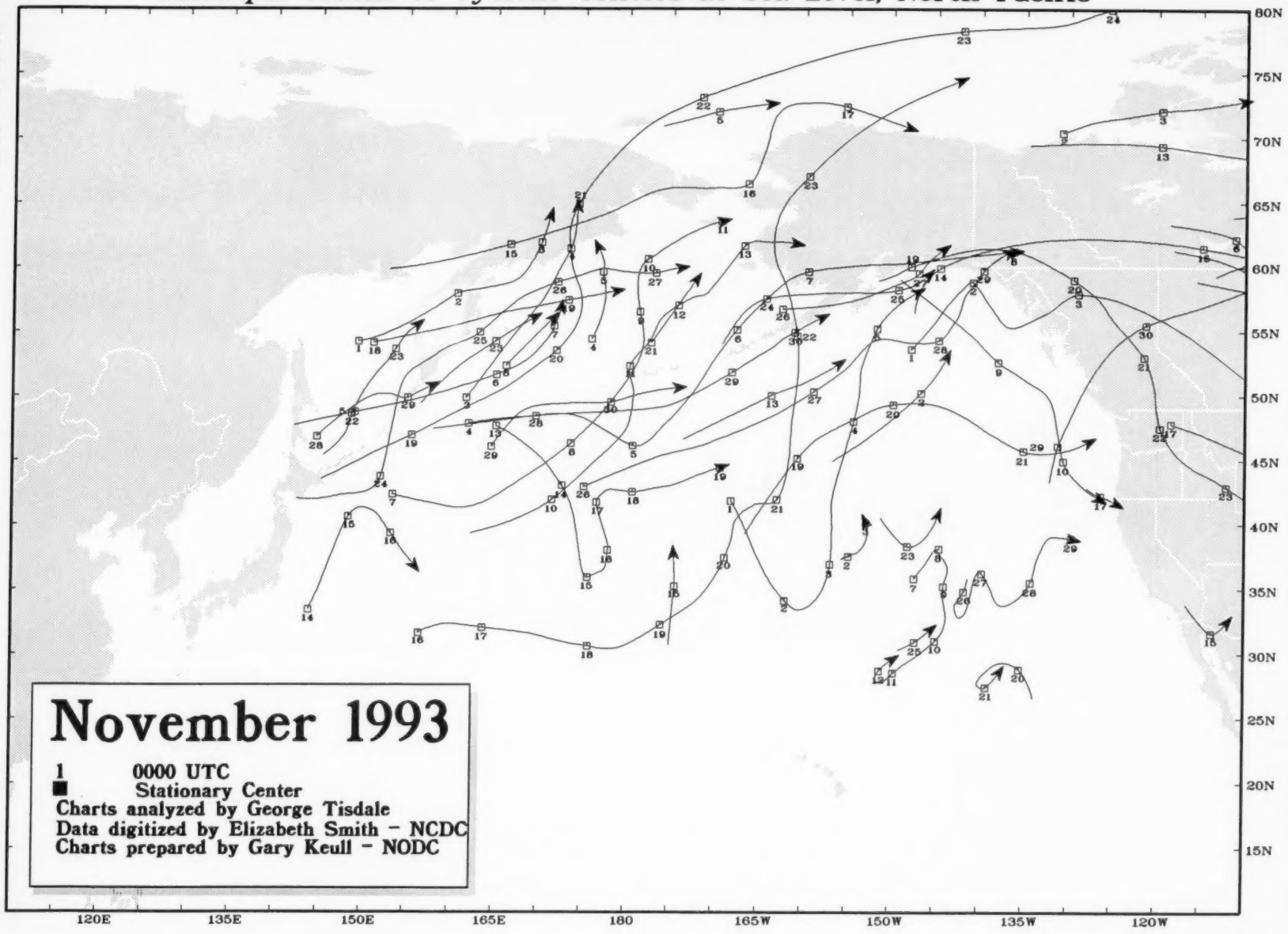


Principal Tracks of Cyclone Centers at Sea Level, North Atlantic




Principal Tracks of Cyclone Centers at Sea Level, North Pacific
October 1993
1 0000 UTC
Stationary Center
Charts analyzed by George Tisdale
Data digitized by Elizabeth Smith - NCDC
Charts prepared by Gary Keull - NODC
80N
75N
70N
65N
60N
55N
50N
45N
40N
35N
30N
25N
20N
15N
120E
135E
150E
165E
180
165W
150W
135W
120W

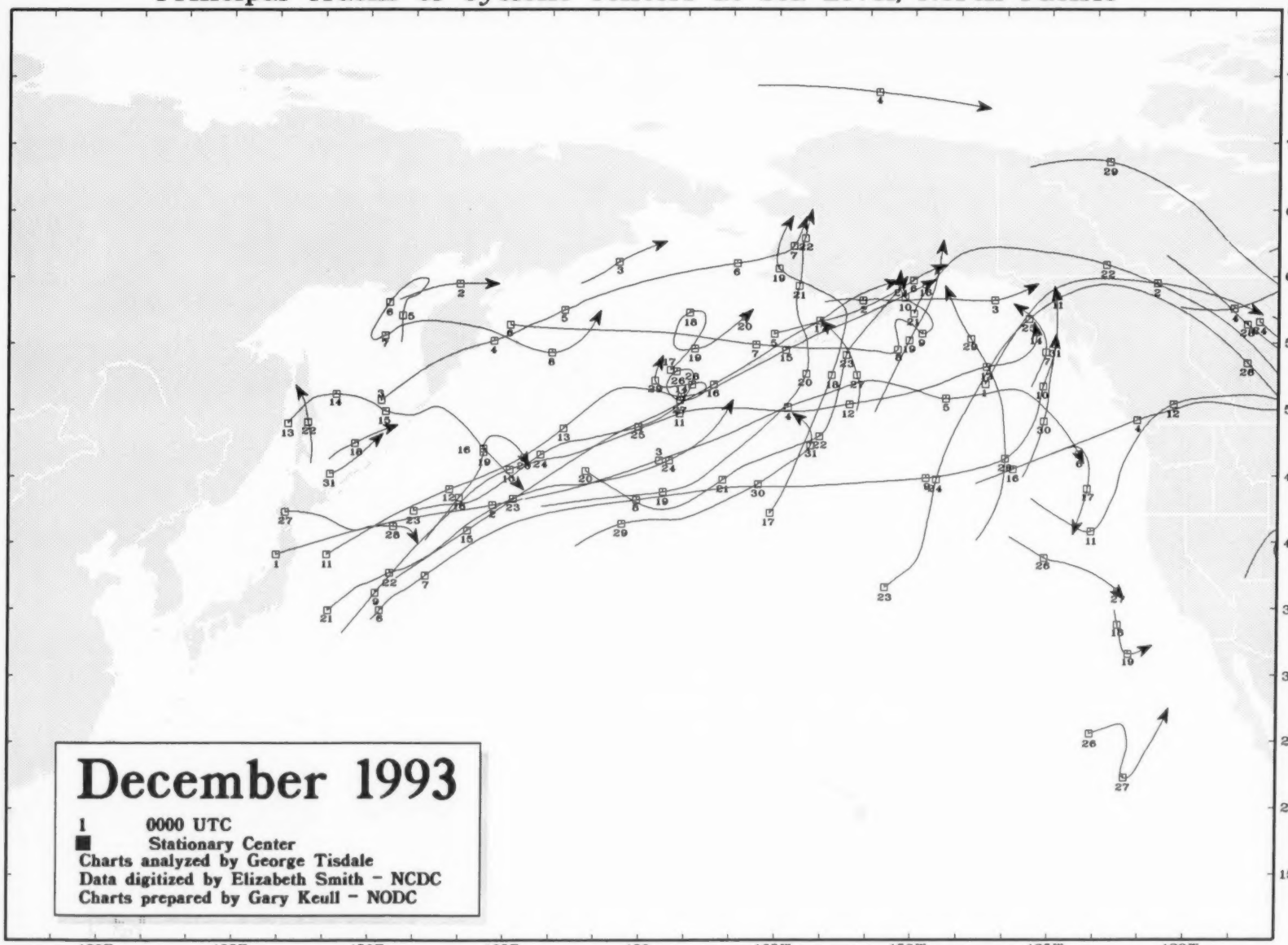
Principal Tracks of Cyclone Centers at Sea Level, North Pacific



November 1993

1 0000 UTC
■ Stationary Center
Charts analyzed by George Tisdale
Data digitized by Elizabeth Smith - NCDC
Charts prepared by Gary Keull - NODC

Principal Tracks of Cyclone Centers at Sea Level, North Pacific



December 1993

1 0000 UTC
■ Stationary Center
Charts analyzed by George Tisdale
Data digitized by Elizabeth Smith - NCDC
Charts prepared by Gary Keull - NODC

October, November and December 1993

	RADIO	MAIL
1ST LT ALEX BONNYMAN	9	
1ST LT BALDOMERO LOPEZ	32	
1ST LT JACK LUMMUS	16	23
2ND LT. JOHN P. BOBO		63
A. V. KASTNER	180	
ACADIA FOREST	123	209
ACE ACCORD	19	
ACT 7	222	
ACT I	107	
ADABELLE LYKES	40	65
ADRIAN MAERSK	1	22
ADVANTAGE	65	23
AFRICAN CAMELLIA	38	
AGULHAS	61	56
ALBEMARLE ISLAND	31	29
ALBERNI DAWN	136	
ALBERT MAERSK	30	29
ALDEBARAN	1	
ALDEN W. CLAUSEN	17	
ALLIGATOR AMERICA	52	
ALLIGATOR COLUMBUS	74	110
ALLIGATOR EXCELLENCE	105	26
ALLIGATOR FORTUNE	34	
ALLIGATOR GLORY	60	128
ALLIGATOR HOPE	80	151
ALLIGATOR JOY	64	68
ALLIGATOR LIBERTY	128	
ALLIGATOR PRIDE	73	86
ALLIGATOR TRIUMPH	55	31
ALMANIA	20	28
ALMEDA STAR	32	
ALPENA	146	168
ALTAMONTE	39	
AMERICA STAR	130	
AMERICAN CONDOR	73	58
AMERICAN CORMORANT	5	
AMERICAN FALCON	63	78
AMERICAN KESTREL	15	
AMERICAN MARINER	29	16
AMERICAN REPUBLIC	24	46
AMERICAN VETERAN		36
AMERICANA	72	83
AMERIGO VESPUCCI	13	9
AMULET	50	21
ANAHUAC	5	
ANDERS MAERSK	103	120
ANNA	51	
ANNA MAERSK	85	43
APJ SHALIN	10	57
ARABIAN SENATOR	224	
ARCO ALASKA		38
ARCO ANCHORAGE	30	30
ARCO CALIFORNIA		53
ARCO FAIRBANKS	53	36
ARCO JUNEAU	5	17
ARCO SPIRIT	3	19
ARCO TEXAS	33	32
ARCTIC OCEAN	11	80
ARGONAUT	63	146
ARIES	15	
ARILD MAERSK	33	
ARMCO	79	101
ARNOLD MAERSK		45
ARTHUR M. ANDERSON	91	108
ARTHUR MAERSK	43	169
ASHLEY LYKES	74	
ASIAN SENATOR	3	
ATIGUN PASS	76	48
ATLANTA BAY	51	
ATLANTIC CARTIER	46	
ATLANTIC COMPASS	85	
ATLANTIC CONVEYOR	83	
ATLANTIC OCEAN	18	30
ATLANTIS II	26	
ATLAS HIGHWAY	17	28
AUSTRAL RAINBOW	21	32
AUTHOR	62	
AVELONA STAR	51	
AXEL MAERSK	10	122
AYA II	126	
B.T. ALASKA	86	33
BAAB ULLAH	9	
BALTIC SUN	66	
BALTIMORE TRADER	112	193
BARBARA ANDRIE	89	61
BARRINGTON ISLAND	85	59
BAY BRIDGE	119	133
BEBEDOURO	143	110
BIBI	186	
BLUE RIDGE	140	126
BOGASARI LIMA	133	
BONN EXPRESS	127	
BOSPORUS BRIDGE	189	204
BOVEC	87	
BP ADVENTURE	68	
BRAVERY	45	43
BRAZILIAN REEFER	10	
BREMEN EXPRESS	12	
BRIDGETON	71	
BRIGIT MAERSK	40	19
BRISBANE STAR	43	
BROOKLYN BRIDGE	185	64
BROOKS RANGE	40	38
BRUCE SMART	41	61
BT NAUTILUS	20	
BUCKEYE	302	318
BUNGA KENANGA	2	
BUNGA KESIDANG	35	
BURDUR	1	36
BURNS HARBOR	411	462
CALCITE II	112	123
CALIFORNIA CERES	78	
CALIFORNIA HERMES	99	
CALIFORNIA LUNA	61	
CALIFORNIA MERCURY	159	
CALIFORNIA ORION	52	43
CALIFORNIA PEGASUS	91	
CALIFORNIA STAR	116	
CALIFORNIA TRITON	89	62
CALIFORNIA ZEUS	43	
CANADIAN LIBERTY	65	28
CAP PALMAS	20	117
CAPE DECISION	19	
CAPE DOUGLAS	49	36
CAPE HATTERAS	37	
CAPE HUDSON	74	79
CAPE MAY	130	
CARINA	41	65
CARLA A. HILLS	109	179
CARMEL	28	73
CAROLINA	60	56
CARTAGENA	88	72
CASON J. CALLAWAY	189	211
CASSIA	11	
CATHAY SPIRIT	27	
CCNI ANTARTICO	45	19
CEDRELA	17	
CELEBRATION	25	18
CENTURY HIGHWAY #2	49	
CENTURY HIGHWAY NO. 1	93	
CENTURY HIGHWAY NO. 5	256	
CENTURY HIGHWAY_NO. 3	95	
CENTURY LEADER NO. 1	69	
CGM LORRAINE	16	
CHACABUCO	97	115
CHARLES LYKES	75	224
CHARLES M. BEEGHLEY	43	
CHARLES PIGOTT		48
CHARLESTON	13	
CHARLOTTE LYKES	44	79
CHC NO.1	14	18
CHEMICAL PIONEER	60	51
CHERRY VALLEY	40	24
CHESAPEAKE TRADER	114	57
CHESTNUT HILL	21	24
CHEVRON ANTWERP	29	19
CHEVRON ATLANTIC		152
CHEVRON BURNABY	65	34
CHEVRON CALIFORNIA	145	172
CHEVRON COLORADO	27	41
CHEVRON EDINBURGH	123	185
CHEVRON FELUY		62
CHEVRON MISSISSIPPI	12	13
CHEVRON OREGON	1	2
CHEVRON PACIFIC	4	34
CHEVRON STAR		27
CHEVRON WASHINGTON	50	66
CHIQUITA BOCAS	15	
CHIQUITA CINCINNATIAN	50	99
CHIQUITA ITALIA	89	
CHIQUITA JEAN	95	
CHIQUITA SCANDINAVIA	124	
CHOAPA	10	
CIELO DI FIRENZE	51	23
CLEMENTINA	49	
CLEVELAND	12	17
CO-OP EXPRESO	52	48
COAST RANGE	13	28
COASTAL EAGLE POINT	4	
COASTAL MANATEE	70	29
COLLEEN SIF	157	167
COLUMBIA BAY	7	
COLUMBIA STAR	315	97
COLUMBUS AMERICA	401	
COLUMBUS AUSTRALIA	130	
COLUMBUS CALIFORNIA	175	
COLUMBUS ISELIN	15	
COLUMBUS NEW ZEALAND	130	
COLUMBUS OHIO	43	39
COLUMBUS QUEENSLAND	111	
COLUMBUS VICTORIA	164	
COLUMBUS WELLINGTON	215	
COMPANION EXPRESS	68	
CONCERT EXPRESS	26	
CONDOLEEZZA RICE	6	
CONTIENTAL WING	127	
CONTSHIP AUSTRALIA	41	
CONTSHIP ENGLAND	12	
CORAH ANN	67	27
CORNUCOPIA	41	120
CORONADO	29	41
CORPUS CHRISTI	148	68
CORWITH CRAMER	103	118
COURIER	39	16
COURTNEY BURTON	105	181
COURTNEY L.	148	211
CPL. LOUIS J. HAUGE JR	17	34
CRISTOFORO COLOMBO	40	48
CROWN PRINCESS	95	
CSL ATLAS	179	
CSL INNOVATOR	58	
CSS HUDSON	119	
DAMODAR KAVERI	20	
DAN MOORE	2	
DANIELLA	86	
DEL MONTE CONSUMER	98	87
DEL MONTE HARVESTER	1	
DEL MONTE TRADER	82	
DELAWARE TRADER	147	1
DELMONTE TRANSPORTER	70	88
DIANA	8	6
DIRECT FALCON	126	201
DIRECT KEA	151	
DIRECT KIWI	100	
DIRECT KOOKABURRA	145	169
DMITRIY OLYANOV	33	
DOCTOR LYKES	167	68
DOLE CALIFORNIA	7	
DON JORGE	11	
DOROTHEE	132	312
DOUBLE GLORY	39	
DSR BALTIC	119	
DSR EUROPE	199	
DUSSELDORF EXPRESS	83	
DYVI BALTIC	17	10
DYVI OCEANIC	95	
E.P. LE QUEBECOIS	235	
ECSTASY	88	131
EDGAR B. SPEER	216	254
EDINBURGH FRUID	22	
EDWARD L. RYERSON	130	165
EDWIN H. GOTT	238	244
EDYTH L.	104	99
EIBE OLDENDORFF		79
ELIZABETH LYKES	14	29
ELIZABETH OLDENDORFF	3	
ELLEN KNUDSEN	24	
ELLENSBORG		61
EMMA OLDENDORFF	74	
ENCHANTED SEAS	3	18
ENDEAVOR 2	4	
EUROPEAN SENATOR	41	
EVER GAINING	6	
EVER GATHER	14	15
EVER GENTLE	4	
EVER GENTRY	11	31
EVER GIANT	10	
EVER GIVEN	10	
EVER GLAMOUR	17	
EVER GLEAMY	11	11
EVER GLOBE	8	1
EVER GLORY	18	22
EVER GLOWING	48	48
EVER GOING	9	
EVER GOODS	26	77
EVER GRADE	10	
EVER GROUP	22	

October, November and December 1993

	RADIO	MAIL
EVER GROWTH	3	
EVER GUARD	8	
EVER GUEST	1	
EVER GUIDE	4	10
EVER LAUREL	34	
EVER LEVEL	27	14
EVER LINKING	8	
EVER LIVING	26	
EVER LYRIC	17	
EXPORT FREEDOM	38	56
EXPORT PATRIOT	45	98
FAIRLIFT	129	
FAIRMAST	73	
FALSTAFF	11	
FANTASY	5	
FAUST	62	92
FEDERAL SKEENA	60	
FERNCROFT	154	20
FESTIVALE	3	26
FETISH	147	156
FIESTAMARINA	47	49
FIR GROVE	46	33
FOREST HAWK	35	
FRANCES HAMMER	154	84
FRANCES L.	81	114
FRED G.	53	
FRED R. WHITE JR	30	36
FREJA ISLANDIA	55	
FREJA SVEA	129	131
FRINES	63	
FUJI	25	
GALVESTON BAY	119	206
GENEVIEVE LYKES	31	38
GEORGE A. SLOAN	123	151
GEORGE A. STINSON	74	93
GEORGE H. WEYERHAEUSER	45	149
GEORGE WASHINGTON BRID	211	27
GEORGIA		101
GEORGIA RAINBOW II	49	
GERMAN SENATOR	40	
GERONIMO	5	
GLOBAL LINK	3	
GLOBAL SENTINEL	114	
GOLDEN APO	5	
GOLDEN GATE	12	
GOLDEN GATE BRIDGE	207	44
GOLDEN MONARCH	1	
GREAT LAND	3	
GREEN BAY	39	38
GREEN CEDAR	53	
GREEN HARBOUR	14	
GREEN ISLAND	29	48
GREEN LAKE	105	115
GREEN MAYA	111	
GREEN RIDGE	86	45
GREEN SASEBO	81	52
GREEN SUMA	71	96
GREEN SYLVAN	24	6
GREEN VALLEY	13	
GREEN WAVE	20	
GROWTH RING	99	57
GUAYAMA	13	7
GULF SPEED	102	
GULF SPIRIT	28	
GYPSUM BARON	186	
GYPSUM KING	119	
H. LEE WHITE	147	179
HANJIN BREMEN	6	
HANJIN CHUNGMU	54	
HANJIN FELIXSTOWE	15	
HANJIN HAMBURG	14	
HANJIN HONG KONG	24	
HANJIN KAOHSIUNG	1	
HANJIN KEELUNG	22	
HANJIN KOBE	24	32
HANJIN LONG BEACH		3
HANJIN MARSEILLES	8	
HANJIN MASAN	35	
HANJIN NEW YORK	36	32
HANJIN OAKLAND	13	6
HANJIN ROTTERDAM	16	
HANJIN SAVANNAH	49	33
HANJIN SEATTLE	9	
HANJIN TONGHAE	17	
HANJIN VANCOUVER	13	
HANJIN YOKOHAMA	28	
HANSA LUBECK	206	85
HANSA VISBY	35	
HEIDELBERG EXPRESS	99	
HENRY HUDSON BRIDGE	222	
HERBERT C. JACKSON	43	49
HEREFORDSHIRE	3	
HERMENIA	81	46
HERMOD	54	
HETTSTEDT	75	
HIBISCUS	90	96
HIRA II		17
HOEGH CLIPPER	13	29
HOEGH DUKE	5	
HOEGH DYKE	17	
HOEGH MERCHANT	5	
HOEGH MINERVA	10	
HOLIDAY	89	99
HONESTA	18	
HOWELL LYKES	67	32
HUAL INGRITA	30	17
HUAL KARINITA	20	
HUAL ROLITA	19	64
HUMACAO	71	107
HUMBERGRACHT	33	
HUNG CHOW	393	
HYUNDAI CONTINENTAL	38	
HYUNDAI DUKE	13	
IBN AL-ATHEER	90	
IBN AL-MOATAZ	17	
INDEPENDENT ACCORD	31	
INDEPENDENT SPIRIT	14	
INDIAN OCEAN		4
INDIANA HARBOR	57	78
INFANTA	204	
INGER	100	24
IOWA TRADER	26	25
ISABELLA	41	
ISLAND PRINCESS	46	
ITB BALTIMORE	46	49
ITB GROTON	86	105
ITB JACKSONVILLE	140	153
ITB MOBILE	22	44
ITB NEW YORK	49	36
ITB PHILADELPHIA	9	5
IVER EXPLORER	60	
IVER EXPRESS	19	
J. DENNIS BONNEY		199
J.W. POWELL	42	
JAHRE SPIRIT	39	
JALAVIHAR	22	37
JALISCO	46	77
JAMES LYKES	65	131
JAMES R. BARKER	142	150
JAPAN RAINBOW 2	72	
JAPAN SENATOR	295	
JEAN LYKES	39	96
JEBEL ALI	35	
JO OAK	1	
JOHN G. MUNSON	306	321
JOHN J. BOLAND	65	88
JOHN LYKES	37	37
JOHN YOUNG		54
JOSEPH H. FRANTZ	222	180
JOSEPH L. BLOCK	71	109
JUBILANT	8	
JUBILEE	11	10
JULIUS HAMMER	142	
KAIMOKU	153	108
KAINALU	155	102
KAKUSHIMA	41	43
KANSAS TRADER	64	46
KAREN ANDRIE	37	
KAUAI	5	
KAYE E. BARKER	97	109
KEE LUNG	45	42
KEISHO MARU	45	
KELVIN CHALLENGE	11	
KENAI	150	201
KENNETH E. HILL	55	52
KENNETH T. DERR	104	166
KENTUCKY HIGHWAY	26	
KEYSTONE CANYON	53	41
KEYSTONER	42	51
KINSMAN ENTERPRISE	3	43
KITTANING	7	14
KOLN EXPRESS	152	
KOPER EXPRESS	36	
KRAS	64	
KURE	16	
LA TRINITY	20	33
LAKE GUARDIAN	9	10
LAUST MAERSK	20	36
LAWRENCE H. GIANELLA	8	1
LEISE MAERSK	1	
LEON	10	
LEONARD J. COWLEY	89	
LEONIA	176	
LERMA	57	
LESLIE LYKES	67	141
LETITIA LYKES	49	66
LIBERTY BELLE	18	36
LIBERTY SEA	25	81
LIBERTY SPIRIT	35	
LIBERTY STAR	34	62
LIBERTY SUN	84	150
LIBERTY VICTORY	9	52
LIBERTY WAVE	24	21
LIRCAY	127	58
LNG AQUARIUS	24	108
LNG CAPRICORN	14	17
LNG LEO	17	34
LNG TAURUS	26	130
LNG VIRGO	88	144
LOA	59	
LONDON ENTERPRISE	83	
LONG LINES	11	
LONGAVI	221	
LOUISE LYKES	31	
LOUISIANA	37	
LT ARGOSY	6	
LT PRAGATI	32	
LT. ODYSSEY	9	
LUCKY BULKER	36	
LUNA MAERSK	92	139
LURLINE	71	182
M. P. GRACE	15	
M S MAASDAM	29	
M T LONDON SPIRIT	50	
MACKINAC BRIDGE	198	40
MADISON MAERSK	52	30
MAERSK CONSTELLATION	59	91
MAERSK JEDDAH	66	70
MAERSK SANTIAGO	47	127
MAERSK SUN	67	98
MAERSK TACOMA	1	
MAGIC	127	
MAGLEBY MAERSK	30	35
MAJ STEPHEN W PLESS MP	3	10
MAJESTIC MAERSK	35	64
MANILA SUNRISE	38	
MANITOU		2
MANUKAI	75	169
MANULANI	92	184
MARATHA MAJESTY	3	
MARCHEN MAERSK	1	15
MAREN MAERSK	55	104
MARGARET LYKES	52	51
MARGRETHE MAERSK	21	70
MARIA TOPIC	1	66
MARIE MAERSK	55	116
MARIF	36	47
MARINE PRINCESS	15	8
MARINE RELIANCE	126	
MARIT MAERSK	19	92
MARJORIE LYKES	40	50
MARLIN		114
MATHILDE MAERSK		61
MATSONIA	123	176
MAUI	43	146
MAURICE EWING	7	133
MAURICIO DE OLIVEIRA	1	
MAYA	25	
MAYAGUEZ	95	73
MAYVIEW MAERSK	23	88
MC-KINNEY MAERSK	32	54
MEDALLION	71	60
MEDUSA CHALLENGER	356	407
MELBOURNE STAR	125	
MELVILLE	109	107
MERCANDIAN CONTINENT	55	22
MERCHANT PRELUDE	45	
MERCHANT PREMIER	76	
MERCHANT PRINCIPAL	155	
MERCURY ACE	6	
MERIDA	88	
MESABI MINER	131	155
METTE MAERSK	13	4
MICHIGAN	229	310
MICHIGAN HIGHWAY	47	
MICRONESIAN COMMERCE	23	
MICRONESIAN INDEPENDEN	3	

October, November and December 1993

	RADIO	MAIL
MICRONESIAN PRIDE	112	
MIDDLETOWN	85	124
MINERVA	13	
MING PLENTY	49	43
MING PROMINENCE	36	
MING PROMOTION	35	
MING PROSPERITY	2	
MITLA	119	64
MIXTECO	84	
MOANA PACIFIC	140	
MOKU PAHU	106	58
MONTERREY	133	41
MORELOS	131	70
MORMACSKY	16	
MORMACSTAR	23	21
MORMACSUN	71	
MT. CABRIT	11	
MYRON C. TAYLOR	138	175
MYSTIC	121	
NACIONAL SANTOS	1	
NAPIER STAR	2	
NARA	100	40
NATIONAL DIGNITY	31	75
NATIONAL HONOR	20	25
NATIONAL PRIDE	19	45
NCC ARAR	10	
NEDLLOYD HOLLAND	64	57
NEDLLOYD MADRAS	10	
NEDLLOYD MARSEILLS	26	
NEDLLOYD ROTTERDAM	160	
NEDLLOYD TOKYO	56	
NEDLLOYD VAN CLOON	103	
NEDLLOYD VAN DIEMEN	9	
NEDLLOYD VAN NECK	67	
NEDLLOYD VAN NOORT	142	
NEPTUNE ACE	60	
NEPTUNE AMBER	20	
NEPTUNE AZURITE	51	
NEPTUNE CORAL	26	
NEPTUNE CRYSTAL	35	
NEPTUNE DIAMOND	100	
NEPTUNE GARNET	48	
NEPTUNE JADE	20	
NEPTUNE PEARL	29	
NEW HORIZON	28	45
NEW NOBLE	15	
NEW YORK SENATOR	14	
NEWARK BAY	78	37
NIEUW AMSTERDAM	78	
NIPPON HIGHWAY	2	
NOAA DAVID STARR JORDA	111	71
NOAA SHIP CHAPMAN	243	250
NOAA SHIP DELAWARE II	120	284
NOAA SHIP DISCOVERER O	454	477
NOAA SHIP FERREL	13	106
NOAA SHIP HECK 591	1	
NOAA SHIP M. BALDRIDGE	28	22
NOAA SHIP MCARTHUR	432	195
NOAA SHIP MILLER FREEM	126	207
NOAA SHIP MT MITCHELL	36	
NOAA SHIP OREGON II	371	284
NOAA SHIP RAINIER	118	
NOAA SHIP SURVEYOR	125	202
NOAA SHIP T. CROMWELL	8	148
NOAA SHIP WHITING	257	307
NOBEL STAR	67	20
NORD JAHRE TARGET	5	
NORTHERN LIGHTS	194	235
NOSAC CEDAR	29	
NOSAC EXPLORER	3	
NOSAC EXPRESS	18	
NOSAC FOREST	126	
NOSAC RANGER	91	151
NOSAC ROVER	9	
NOSAC TAKAYAMA		256
NUEVO SAN JUAN	36	75
NURNBERG ATLANTIC	178	
NYK SPRINGTIDE	210	
NYK STARLIGHT	59	
NYK SURFWIND	36	
OAXACA	149	176
OBO ENGIN	11	
OCEAN BRIDGE	21	
OCEAN CHEER	9	
OCEAN HIGHWAY	43	
OCEAN SPIRIT	368	
OCEAN VICTOR	65	35
ODELIA	10	5
OLEANDER	152	83
OMI MISSOURI	31	
OMI WILLAMETTE	76	55
OOCL BRAVERY	85	
OOCL EDUCATOR	42	
OOCL ENVOY	62	21
OOCL EXECUTIVE	74	35
OOCL EXPLORER	88	76
OOCL EXPORTER	109	
OOCL FAIR	85	
OOCL FAITH	20	
OOCL FAME	94	
OOCL FIDELITY	109	69
OOCL FORTUNE	118	9
OOCL FREEDOM	61	
OOCL FRIENDSHIP	73	
OOCL INNOVATION	80	59
OOCL INSPIRATION	126	36
ORANGE BLOSSOM	22	
ORANGE STAR	22	130
ORANGE WAVE		67
OREGON STAR	169	
ORION HIGHWAY	117	41
OURO DO BRASIL	133	107
OVERSEAS ALASKA	59	24
OVERSEAS ALICE	3	
OVERSEAS ARCTIC	56	
OVERSEAS CHICAGO	28	144
OVERSEAS HARRIET	1	
OVERSEAS JOYCE	52	
OVERSEAS JUNEAU		58
OVERSEAS MARILYN	33	
OVERSEAS NEW ORLEANS	70	30
OVERSEAS NEW YORK	37	129
OVERSEAS OHIO	23	66
OVERSEAS PHILADELPHIA		45
PACASIA	53	
PACIFIC EMERALD	1	5
PACIFIC PRINCESS	143	
PACKING	18	
PACMERCHANT	53	
PACOCEAN	29	
PACPRINCE	36	
PACPRINCESS	36	
PACQUEEN	38	15
PACSTAR	13	
PAPAGO	65	88
PARIS SENATOR	6	
PATRIOT	19	2
PAUL BUCK	50	31
PAUL H. TOWNSEND	222	208
PAUL R. TREGURTHA	325	365
PC EXPLORER		26
PERMEKE	10	
PETER W. ANDERSON	37	
PETROBULK PROGRESS	2	
PFC DEWAYNE T. WILLIAM	50	
PFC EUGENE A. OBREGON	42	14
PFC JAMES ANDERSON JR	12	20
PHAROS	38	
PHILIP R. CLARKE	130	151
PHOENIX DIAMOND	56	
PIERRE FORTIN	295	
PISCES PLANTER	154	
PLATTE	29	13
POLAR ALASKA	53	144
POLYNESIA	183	141
POTOMAC	33	
PRESIDENT ADAMS	98	87
PRESIDENT ARTHUR	65	66
PRESIDENT BUCHANAN	23	21
PRESIDENT EISENHOWER	138	181
PRESIDENT F. ROOSEVELT	207	193
PRESIDENT FILMORE	40	33
PRESIDENT GARFIELD	45	
PRESIDENT GRANT	74	81
PRESIDENT HARDING	62	
PRESIDENT HARRISON	89	
PRESIDENT HOOVER	43	110
PRESIDENT JACKSON	151	187
PRESIDENT JEFFERSON	60	113
PRESIDENT KENNEDY	144	75
PRESIDENT LINCOLN	51	209
PRESIDENT MONROE	162	163
PRESIDENT POLK	165	166
PRESIDENT TRUMAN	31	115
PRESIDENT TYLER	35	107
PRESIDENT VAN BUREN	14	
PRESIDENT WASHINGTON	126	221
PRESQUE ISLE	287	337
PRIDE OF BALTIMORE	74	
PRINCE OF OCEAN	87	168
PRINCE OF TOKYO	119	64
PRINCE OF TOKYO 2	106	187
PRINCE WILLIAM SOUND	23	95
PUEBLA	85	
PUERTO CORTES	98	
PVT FRANKLIN J. PHILLI	14	18
PYTCHLEY	178	
QUEEN ELIZABETH 2	142	
QUEENSLAND STAR	167	
R.J. PFEIFFER	144	122
RAINBOW HOPE	121	135
RAINBOW WARRIOR	2	
RALEIGH BAY	79	172
RANGER III	1	
RANI PADMINI	54	
RECIFE	389	68
REGAL EMPRESS	2	
REPULSE BAY	77	
RESERVE	124	152
RESOLUTE	61	158
RHINE FOREST	82	11
RICHARD G MATTIESEN	45	45
RICHARD REISS	89	
RIJEKA EXPRESS	1	
ROBERT E. LEE	10	
ROSINA TOPIC	29	39
ROTTERDAM	157	
ROVER	22	
ROWANBANK	100	
ROYAL PRINCESS	91	
RUBIN DOGA	42	
RUBIN OCEAN	24	6
RUTH LYKES	31	53
S.T. CRAPO	152	190
SALINA CRUZ PILOTS	185	31
SALINAS	23	117
SAM HOUSTON	20	
SAMUAL GINN	34	84
SAMUEL H. ARMACOST	63	73
SAMUEL L. COBB	59	24
SAMUEL RISLEY	570	
SAN LORENZO	11	
SAN LUIS	19	
SAN MARCOS	94	73
SAN MARTIN	54	
SAN PEDRO	91	
SAN VINCENTE	28	
SANTA FE		24
SANTA FE DE BOGOTA	15	
SANTA MARTA	21	
SANTA MONICA	94	
SANTA PAULA	119	139
SANTORIN 2	91	315
SAPAI	5	
SAVANNAH	45	
SCARAB	5	
SEA BELLS	34	188
SEA COMMERCE	110	40
SEA FAN	37	82
SEA FORTUNE	43	102
SEA FOX	65	
SEA LIGHT	28	22
SEA LION	272	264
SEA MERCHANT	352	292
SEA SPRAY	3	
SEA TRADE	16	
SEA WOLF	147	95
SEA-LAND SHINING STAR	105	106
SEABOARD OCEAN	239	249
SEABOARD SUN	43	44
SEALAND ACHIEVER	149	92
SEALAND ANCHORAGE	75	149
SEALAND ATLANTIC	71	132
SEALAND CHALLENGER	72	152
SEALAND CONSUMER	195	120
SEALAND CRUSADER	143	94
SEALAND DEFENDER	74	128
SEALAND DEVELOPER	90	156
SEALAND DISCOVERY	39	
SEALAND ENDURANCE	83	118
SEALAND ENTERPRISE	157	144
SEALAND EXPEDITION	44	52
SEALAND EXPLORER	102	126
SEALAND EXPRESS	184	117
SEALAND HAWAII	238	249
SEALAND INDEPENDENCE	87	40
SEALAND INNOVATOR	92	76

October, November and December 1993

	RADIO	MAIL
SEALAND INTEGRITY	225	189
SEALAND LIBERATOR	60	86
SEALAND MARINER	82	38
SEALAND NAVIGATOR	197	100
SEALAND PACIFIC	233	151
SEALAND PATRIOT	53	
SEALAND PERFORMANCE	25	151
SEALAND PRODUCER	87	200
SEALAND QUALITY	73	69
SEALAND RELIANCE	122	227
SEALAND SPIRIT	105	226
SEALAND TACOMA	43	48
SEALAND TRADER	223	224
SEALAND VALUE	64	137
SEALAND VOYAGER	86	51
SEARIVER BATON ROUGE	30	34
SEARIVER BENICIA	28	12
SEARIVER CHARLESTOWN	13	16
SEARIVER LONG BEACH	35	
SEARIVER MEDITERRANEAN	25	
SEARIVER NEW ORLEANS	9	
SEARIVER NORTH SLOPE	20	
SEARIVER PHILADELPHIA	8	6
SEARIVER SAN FRANCISCO	22	29
SEAWARD JOHNSON	27	29
SEDCO BP 471	150	
SENATOR	119	
SENSATION	38	81
SGT WILLIAM A BUTTON	36	
SHELDON LYKES	84	170
SHELLY BAY	68	117
SHENAHON	2	1
SHIRAOI MARU	113	32
SIDNEY STAR	210	
SINBAD	29	
SINCERE GEMINI	6	
SKANDERBORG		37
SKAUBRYN	130	
SKAUGRAN	177	123
SKAUKAR	33	26
SKODSBORG	12	24
SKOGAFOSS	50	
SN	17	
SOKOLICA	31	19
SOL DO BRASIL	1	
SOLAR WING	92	86
SONORA	68	76
SOREN TOUBRO	6	
SOUTHERN PRINCESS		240
ST BLAIZE	96	
ST. CLAIR	16	
ST. LUCIA	38	
STAFFORDSHIRE	161	
STAR ALABAMA	30	40
STAR AMERICA	42	135
STAR DRIVANGER	124	
STAR DROTTANGER	156	
STAR EAGLE	94	115
STAR EVVIVA	89	119
STAR FLORIDA	121	104
STAR FRASER	83	
STAR FUJI	50	
STAR GEIRANGER	21	24
STAR GRAN	45	143
STAR MERIT	1	
STAR SKARVEN	21	
STAR SKOGANGER	38	135
STAR STRONEN	28	
STAR WILMINGTON	38	
STARSHIP MAJESTIC	9	36
STELLA LYKES	30	20
STELLAR BENY	121	
STELLAR VENUS	10	
STENA TRANSFER	180	255
STEWART J. CORT	474	518
STOLT CONDOR	11	
STONEWALL JACKSON	38	35
STRIDER ISIS	9	
STRONG ICELANDER	20	70
STRONG VIRGINIAN	5	1
SUE LYKES	37	42
SUGAR ISLANDER	27	
SUN VIKING		12
SUNBELT DIXIE	81	123
SUNRISE	5	
SUNRISE RUBY	81	
SWIFTNES	44	
SYNNOVE KNUSTEN	83	77
TABASCO	153	72
TABUK	59	
TAI HE	95	
TAI SHING	52	24
TAMAMONTA	28	
TAMPA	37	
TAMPA BAY	20	16
TARKWA	1	
THOMAS G. THOMPSON	140	91
THOMPSON LYKES	64	54
THOMPSON PASS	2	
TILLIE LYKES	44	128
TOKYO HIGHWAY	79	
TOLUCA	143	72
TONSINA	36	127
TORM FREYA	66	
TOWER BRIDGE	61	
TRANSWORLD BRIDGE	159	79
TRICORD SUCCESS	1	
TRITON	184	239
TROPIC DAY	63	161
TROPIC FLYER	2	109
TROPIC ISLE		8
TROPIC JADE	57	156
TROPIC KEY	74	179
TROPIC LURE		71
TROPIC MIST		74
TROPIC NIGHT		105
TROPIC OPAL		34
TROPIC REIGN	8	104
TROPIC SUN	64	99
TROPIC TIDE	21	60
TROPICAL BEAUTY		74
TROPICALE	24	27
TRUSKAVETS	42	
TSL BOLD		189
TULSIDAS	36	
TYSON LYKES	42	56
UCHOA	77	177
ULLSWATER	219	
ULTRAMAX	32	62
ULTRASEA	50	105
UNIVERSE	23	
USCGC ACACIA (WLB406)	11	
USCGC ACTIVE WMEC 618	32	
USCGC ACUSHNET WMEC 16	24	
USCGC BASSWOOD (WLB 38	40	
USCGC BEAR (WEMC 901)	15	
USCGC BISCAYNE BAY	1	10
USCGC BOUTWELL WHEC 71	37	
USCGC BRAMBLE (WLB 392	14	
USCGC CAMPBELL	76	
USCGC CHASE (WHEC 718)	21	26
USCGC CITRUS (WMEC 300	42	31
USCGC CONFIDENCE WMEC6	72	68
USCGC COURAGEOUS	13	16
USCGC DECISIVE WMEC 62	24	
USCGC DEPENDABLE	10	
USCGC DURABLE (WMEC 62	42	
USCGC FIREBUSH WLB 393	6	
USCGC FORWARD	88	
USCGC GALLATIN	48	
USCGC GALVESTON ISLAND	5	
USCGC HAMILTON WHEC 71	17	
USCGC HARRIET LANE	15	
USCGC IRONWOOD (WLB 29	13	
USCGC JARVIS (WHEC 725	69	
USCGC LAUREL (WLB 291)	18	
USCGC LEGARE	42	
USCGC MACKINAW	14	6
USCGC MALLOW (WLB 396)	54	21
USCGC MELLON (WHEC 717	15	
USCGC MOHAWK WMEC 913	98	24
USCGC MORGENTHAU	101	
USCGC NORTHLAND WMEC 9	56	1
USCGC PLANETREE	28	
USCGC POLAR SEA__(WAGB	223	
USCGC POLAR STAR (WAGB	76	81
USCGC RELIANCE WMEC 61	5	
USCGC RUSH	186	
USCGC SASSAFRAS	2	
USCGC SENECA	72	
USCGC SPENCER	13	
USCGC STORIS (WMEC 38)	71	69
USCGC SUNDEW (WLB 404)	9	
USCGC SWEETBRIER WLB 4	3	
USCGC TAHOMA	55	
USCGC TAMPA WMEC 902	3	3
USCGC THETIS		46
USCGC VENTUROUS WMEC 6	1	
USCGC VIGILANT WMEC 61	6	
USCGC VIGOROUS WMEC 62	30	50
USCGC YOCONA (WMEC 168	50	
USNS ALGOL	80	
USNS ALTAIR	122	176
USNS ANTARES		17
USNS APACHE (T-ATF 172	38	
USNS CATAWBA T-ATF 168	5	7
USNS DENEBOLA	43	24
USNS GUADALUPE	23	
USNS GUS W. DARNELL	59	
USNS HAYES	15	
USNS HENRY J. KAISER		14
USNS JOHN LENTHALL		27
USNS JOHN MCDONNELL (T	10	
USNS KANAWHA T-AO 196		112
USNS KANE TAGS 27	3	
USNS LEROY GRUMMAN		101
USNS LITTLEHALES (T-AG	81	72
USNS MAURY	4	
USNS MOHAWK (T-ATF 170	70	65
USNS NARRAGANSETT	89	89
USNS NAVAJO_(TATF-169)	37	
USNS PECOS	61	
USNS POWHATAN TATF 166	1	
USNS REGULUS	28	
USNS SEALIFT ANTARCTIC	20	17
USNS SEALIFT ARABIAN S	54	
USNS SEALIFT ARCTIC	92	72
USNS SEALIFT ATLANTIC	207	69
USNS SEALIFT CHINA SEA	42	
USNS SEALIFT INDIAN OC	14	34
USNS SEALIFT MEDITERRA	127	53
USNS SILAS BENT T-AGS		39
USNS SIOUX	79	96
USNS VANGUARD TAG 194	94	69
USNS WALTER S. DIEHL		40
USNS WILKES T-AGS-33	102	63
VEGA	176	
VELMA LYKES	53	
VENUS DIAMOND	140	
VERA ACORDE	31	
VINA DEL MAR	8	
VINE	154	
VIRGINIA	42	55
VISHVA SHAKTI	4	
VIVA	32	61
WASHINGTON HIGHWAY	44	
WEST MOOR	157	
WESTWARD	56	69
WESTWARD VENTURE	139	154
WESTWOOD ANETTE	69	138
WESTWOOD BELINDA	34	35
WESTWOOD CLEO	143	59
WESTWOOD JAGO	145	52
WESTWOOD MARIANNE	47	171
WILFRED SYKES	216	260
WOLVERINE	27	31
WORLD WING #2	98	205
YAMANAKA MARU	108	
YANKEE CLIPPER	16	
YOUNG SATO	31	
YOUNG SPROUT	69	43
ZETLAND	152	
ZIM AMERICA	84	
ZIM CANADA	49	
ZIM HOUSTON	8	
ZIM IBERIA	119	
ZIM KEELUNG	78	
ZIM MARSEILLES	1	
ZIM MIAMI	9	
ZIM SAVANNAH	39	

SUMMARY:

GRAND TOTAL VIA RADIO 69196

GRAND TOTAL VIA MAIL 48582

TOTAL UNIQUE OBS 90194

TOTAL DUPLICATES 27584 (30.6%)

UNIQUE RADIO OBS.41612 (46.1%)

UNIQUE MAIL OBS. 20998 (23.3%)

October, November and December 1993

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME	CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
BOAB	95	95	0	TAI HE	JFDG	23	23	0	SHUMPU MARU
CBVM	7	7	0	VINA DEL MAR	JFPQ	38	38	0	KASHIMASAN MARU
CGBS	179	0	179	PARIZEAU	JGZK	43	43	0	RYOFU MARU
CGDG	106	0	106	HUDSON	JITV	140	140	0	WELLINGTON MARU
CGDV	290	12	278	W. TEMPLEMAN	JIVB	105	105	0	SEIFU MARU
CG2676	37	0	37	SHAMOOK	JSLE	8	8	0	***
CG2680	5	5	0	MARINUS	JSUG	1	1	0	***
CG2683	65	0	65	ALFRED NEEDLER	KGJB	1	1	0	SEALAND DEFENDER
CG2958	38	0	38	TULLY	KIRH	138	138	0	SEALAND TRADER
CZDO	26	26	0	QUEST	KJDG	20	20	0	TONSINA
C6JY6	137	137	0	MELBOURNE STAR	KJLV	21	21	0	***
C6JZ2	111	111	0	AMERICA STAR	KNBD	1	1	0	DELAWARE II
DAKE	90	90	0	KOELN EXPRESS	KNFG	71	71	0	SEA WOLF
DBFP	25	25	0	WALTHER HERWIG	KRGB	80	80	0	SEALAND ENTERPRISE
DBLK	98	98	0	POLARSTERN	LADB2	61	61	0	SKAUGRAN
DD8436	30	30	0	FEHMARNBELT	LAJV4	38	38	0	SKAUBRYN
DGLM	102	102	0	MONTE ROSA	LDGJ	3	0	3	***
DGVK	84	84	0	COLUMBUS VICTORIA	LLZG	129	0	129	***
DHCM	77	77	0	COLUMBUS CALIFORNIA	LOAI	16	16	0	ALMIRANTE IRIZAR
DHCW	84	84	0	COLUMBUS WELLINGTON	LOAM	2	2	0	***
DIDA	66	66	0	ARIANA	LOAP	16	16	0	***
D5BC	37	37	0	SEDCO BP/471	LRAQ	48	0	48	EDUARDO L. HOLMBERG
D5ND	45	45	0	SAINT LUCIA	LRGS	100	0	100	***
D5NE	90	90	0	MT CABRITE	NAVOC	115	115	0	U.S. NAVAL OCEANO-
D5NZ	119	119	0	POLYNESIA	GRAPHIC				
ELAX2	38	38	0	MICRONESIAN PRIDE	NAVOCE	671	671	0	U.S. NAVAL OCEANO-
ELBX3	4	4	0	PACKING	GRAPHIC				
ELDM8	2	2	0	SEA ISLAND	NAVPAC	3	3	0	***
ELEH4	26	26	0	DELMAS TOURVILLE	NBTM	6	6	0	POLAR STAR
ELIL9	43	43	0	T A NAVIGATOR	NDDW	2	2	0	HEWITT
ELIS8	62	62	0	T A MARINER	NIKA	33	33	0	SEALIFT ATLANTIC
ELOF6	40	40	0	LONGAVI	NJHD	1	1	0	DOYLE
ERES	16	14	2	VICTOR BUGAEN	NNJB	40	40	0	***
FHZI	23	23	0	L'ASTROLABE	NNUD	236	236	0	SILAS BENT
FNDH	23	23	0	***	NRL	289	289	0	***
FNDK	40	40	0	PATRICIA DELMAS	NRUO	32	32	0	POLAR SEA
FNJT	2	2	0	KORRIGAN	NTRI	4	4	0	WILKES
FNPA	25	25	0	RONSARD	NVLA	1	1	0	***
FNQC	22	22	0	RENEE DELMAS	NWAR	2	2	0	***
FNQM	56	56	0	SUZANNE DELMAS	NZSK	10	10	0	E.KANE
FNWC	39	39	0	NATHALIE DELMAS	N900AM	37	37	0	***
FNXN	20	20	0	SAINT ROMAIN	OWUO6	66	66	0	MOANA PACIFIC
FNXW	3	3	0	SAINT ROCH	PGEB	41	41	0	***
FNZP	11	11	0	RACINE	PGEC	19	19	0	NEDLLOYD VAN NOORT
FNZQ	3	3	0	RIMBAUD	PJJU	68	68	0	OLEANDER
GACA	160	160	0	CUMULUS	P3LK3	38	38	0	SAINT GEORGES
GUCL	7	7	0	**	SCFL	1	1	0	***
GXRH	36	36	0	ENDURANCE	SCPI	1	1	0	TV 258
GYRW	40	40	0	ENCOUNTER BAY	SEXN	2	2	0	TV 227
GYSA	23	23	0	FLINDERS BAY	SHIP	1506	1506	0	***
GYSE	39	39	0	NEDLLOYD TASMAN	SHPF	1	1	0	TV 281
HPAN	44	44	0	MICRONESIAN COMMERCE	SKVP	3	3	0	TV 284
HPEW	135	135	0	PACIFIC ISLANDER	SMZQ	2	2	0	TV 102
H9BQ	22	22	0	MICRONESIAN INDEPEN-	S6FK	99	99	0	SWAN REEFER
DENCE					TFJA	22	22	0	ARNI FRIDRIKSSON
JBOA	66	66	0	KEIFU MARU	TFVD	25	25	0	***
JCCX	68	68	0	CHOFU MARU	UJFO	86	86	0	MULTANOVSKY PROF
JDWX	109	109	0	KOFU MARU	UZFA	1	0	1	***

October, November and December 1993

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
VC9450	172	8	164	GADUS ATLANTICA
VJBQ	27	27	0	ANRO AUSTRALIA
VJDI	37	37	0	IRON NEWCASTLE
VJDP	60	60	0	IRON PACIFIC
VKCN	82	82	0	CANBERRA
VKCV	107	107	0	DERWENT
VKLA	53	53	0	ADELAIDE
VKLP	38	38	0	HMAS MELBOURNE
VKMK	112	112	0	SWAN
VKML	60	60	0	SYDNEY
VKPT	72	72	0	PERTH
VLNB	10	10	0	TORRENS
VSBI3	121	121	0	BIBI
VXZM	36	0	36	
V2PM	6	6	0	WESTMOOR
V2QT	19	19	0	***
WPGK	69	69	0	SEALAND NAVIGATOR
WPKD	112	112	0	SEALAND ACHIEVER
WSRL	36	36	0	SEALAND PACIFIC
WTEA	2	0	2	DISCOVERER
WTES	31	31	0	SURVEYOR
WTDK	24	24	0	D.S. JORDAN
WTDO	6	1	5	OREGON II
WTEA	57	10	47	DISCOVERER
WTEJ	21	21	0	MCARTHUR
WTES	6	6	0	SURVEYOR
YDLR	62	62	0	BOGASARI LIMA
Y3CW	17	0	17	A. V. HUMBOLDT
ZCAQ9	176	176	0	WEST MOOR
ZCKP	14	14	0	STAR DRIVANGER
ZCKU	55	55	0	STAR DROTTANGER
ZDAZ6	60	60	0	T A EXPLORER
3EGR6	34	34	0	RECIFE
3EHE6	193	193	0	ENFANTA
3EHT6	88	88	0	KARINA BONITA
7JOB	1	1	0	CALIFORNIA CERES
9VBZ	10	10	0	MAHSURI
9VUU	12	12	0	ANRO ASIA
9VVB	91	91	0	GOLDENSARI INDAH
9VWM	17	17	0	NEW ZEALAND STAR
21002	733	733	0	BUOY
21004	743	743	0	BUOY
22001	732	732	0	BUOY
23001	99	99	0	BUOY
32315	60	60	0	BUOY
32316	50	50	0	BUOY
32317	62	62	0	BUOY
32318	41	41	0	BUOY
32319	67	67	0	BUOY
32321	81	81	0	BUOY
32322	73	73	0	BUOY
43001	74	74	0	BUOY
51006	85	85	0	BUOY
51007	64	64	0	BUOY
51008	67	67	0	BUOY
51009	84	84	0	BUOY
51010	64	64	0	BUOY
51011	38	38	0	BUOY
51014	77	77	0	BUOY
51015	83	83	0	BUOY
51016	71	71	0	BUOY
51017	37	37	0	BUOY
51018	49	49	0	BUOY
51019	63	63	0	BUOY
51020	45	45	0	BUOY
51021	89	89	0	BUOY
51022	147	147	0	BUOY
51023	65	65	0	BUOY
51301	19	19	0	BUOY
51302	79	79	0	BUOY
51303	68	68	0	BUOY
51304	71	71	0	BUOY
51305	80	80	0	BUOY
51306	77	77	0	BUOY
51307	48	48	0	BUOY
51308	48	48	0	BUOY
51309	68	68	0	BUOY
51310	12	12	0	BUOY
52001	11	11	0	BUOY
52002	78	78	0	BUOY
52003	84	84	0	BUOY
52004	62	62	0	BUOY
52006	93	93	0	BUOY
52007	68	68	0	BUOY
52008	79	79	0	BUOY
52010	5	5	0	BUOY
52011	44	44	0	BUOY
52012	63	63	0	BUOY
52301	9	9	0	BUOY
52302	71	71	0	BUOY
52306	76	76	0	BUOY
52307	82	82	0	BUOY
52309	54	54	0	BUOY
52310	65	65	0	BUOY
52311	63	63	0	BUOY
52312	73	73	0	BUOY
52313	67	67	0	BUOY
52314	70	70	0	BUOY
52315	12	12	0	BUOY
52316	13	13	0	BUOY

TOTAL BATHYS RECEIVED	14560
TOTAL TESACS RECEIVED	1257
TOTAL REPORTS RECEIVED	15817

October, November and December 1993

Wave observations are taken each hour during a 20-minute averaging period, with a sample taken every 0.67 seconds. The significant wave height is defined as the average height of the highest one-third of the waves during the average period each hour. The maximum significant wave height is the highest of those values for that month. At most stations, air temperature, water temperature, wind speed and direction are sampled once per second during an 8.0-minute averaging period each hour (moored buoys) and a 2.0-minute averaging period for fixed stations (C-MAN). Contact NDBC Data Systems Division, Bldg 1100, SSC, Mississippi 39529 or phone (601) 688-2838 for more details.

BUOY CLIMATOLOGICAL DATA SUMMARY

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA HR)	MEAN PRESS (MB)
OCTOBER 1993													
32302	18.0S	085.1W	0738	17.9	18.6	2.3	4.5	13 17	13.5	SE	23.3	05 05	1016.1
41001	34.7N	072.7W	0743	22.7	24.7	1.9	5.3	27 16	13.4	E	33.2	30 20	1017.0
41002	32.3N	075.2W	0743	24.0	25.5	1.8	4.9	31 23	13.5	E	32.3	23 12	1016.1
41004	32.5N	079.1W	0740	22.6	25.4	1.3	4.1	07 19	13.5	NE	30.5	26 19	1015.5
41006	29.3N	077.4W	0742	26.0	27.5	1.6	5.3	31 23	11.8	NE	28.8	31 15	1015.1
41009	28.5N	080.2W	1486	25.6	27.5	1.1	3.7	06 20	10.7	NE	33.6	06 19	1014.9
41010	28.9N	078.5W	1485	26.2	27.5	1.5	4.3	31 19	11.2	NE	28.2	31 16	1015.2
41016	24.6N	076.5W	0744	28.0	29.5	0.4	1.1	12 21	9.4	E	19.2	12 20	1014.5
42001	25.9N	089.7W	0744	26.2	28.0	1.1	4.3	31 10	12.9	NE	33.0	30 12	1014.9
42002	25.9N	093.6W	0742	26.3	28.3	1.3	4.8	30 16	13.7	NE	34.2	30 07	1014.8
42003	25.9N	085.9W	0743	26.4	27.9	1.0	4.4	31 14	11.6	NE	30.9	31 11	1015.2
42007	30.1N	088.8W	0606	22.4	25.2				11.0	SE	31.9	30 13	1016.1
42019	27.9N	095.0W	0744	26.8	27.4	1.4	3.9	30 15	12.7	NE	29.6	30 04	1015.5
42025	25.0N	080.5W	0743	27.3	28.2	0.4	2.1	31 07					
42035	29.3N	094.4W	0743	22.8	25.6	0.9	2.5	30 08	12.0	N	32.4	30 05	1016.2
44004	38.5N	070.7W	0742	18.1	21.0	2.0	6.2	27 10	14.1	SW	38.9	27 19	1017.3
44005	42.6N	068.5W	0326	10.6	11.5	2.0	5.3	28 02	17.3	S	35.4	27 22	1016.5
44007	43.5N	070.1W	0741	9.4	10.7	1.0	3.5	28 07	13.0	SW	29.7	04 09	1017.7
44008	40.5N	069.4W	0741	13.8	14.8	1.6	5.3	27 19	15.2	E	41.0	09 12	1017.8
44009	38.5N	074.7W	0744	15.7	16.5	1.0	4.6	27 12	11.5	S	28.4	27 12	1018.3
44011	41.1N	066.6W	0020	12.7	16.3	2.1	2.5	01 10	14.6	N	19.0	01 05	1022.7
44013	42.4N	070.8W	0743	10.7	11.1	0.8	3.6	31 07	12.2	W	29.7	31 04	1017.3
44014	36.6N	074.8W	0738	18.5	20.0	1.4	6.3	27 04	12.6	NE	36.1	27 08	1017.0
44025	40.3N	073.2W	0740	14.1	15.5	1.3	4.3	27 16	14.2	E	30.9	31 02	1017.6
45001	48.1N	087.8W	0743	4.8	6.7	1.2	3.7	21 18	15.4	NW	36.1	21 11	1013.6
45002	45.3N	086.4W	0744	8.7	11.8	1.3	5.2	01 10	16.9	S	34.8	01 07	1013.7
45003	45.3N	082.7W	0695	7.6	9.1	1.2	4.5	01 15	15.8	NW	33.4	21 16	1013.7
45004	47.6N	086.5W	0744	5.0	6.9	1.3	6.6	21 17	15.0	NW	40.6	21 16	1013.1
45005	41.7N	082.4W	0744	11.4	13.5	0.6	2.2	21 12	12.5	SW	30.9	21 11	1016.7
45006	47.3N	089.9W	0743	5.5	6.5	1.1	3.3	07 18	10.9	NW	23.6	21 12	1013.8
45007	42.8N	087.1W	0740	9.6	10.8	1.0	4.0	09 08	13.9	S	30.5	21 07	1015.6
45008	44.3N	082.4W	0743	8.8	10.3	1.3	3.5	21 14	13.4	S	31.2	21 12	1015.1
45010	43.0N	087.8W	0740	9.0	9.6	0.6	3.4	09 10	11.1	SW	25.8	09 05	1015.3
46001	56.3N	148.2W	0742	9.4	10.1	2.8	6.0	07 16	15.6	W	32.4	29 02	1007.2
46002	42.5N	130.3W	0737	16.2	16.9	2.0	4.5	23 02	9.9	NW	21.8	23 17	1018.6
46003	51.9N	155.9W	0739	8.8	9.5	3.2	7.7	03 18	16.3	W	41.6	03 18	1007.7
46005	46.1N	131.0W	0742	15.3	15.9	2.1	5.4	23 09	10.7	S	25.1	23 18	1018.9
46006	40.9N	137.5W	0738	17.7	18.3	2.2	4.6	22 14	11.3	N	23.1	07 09	1019.9
46013	38.2N	123.3W	0742	13.4	13.3	1.6	3.5	24 18	9.1	NW	26.0	08 01	1015.9
46014	39.2N	124.0W	0739	13.0	12.8	1.7	4.1	23 21	8.3	NW	22.5	17 02	1016.8
46022	40.8N	124.5W	0738	12.6	12.5	1.6	4.4	23 17	6.6	N	21.6	11 00	1017.2
46023	34.3N	120.7W	0743	15.9	16.3	1.5	2.9	25 08					1015.4
46025	33.8N	119.1W	0742	18.2	19.1	1.2	1.5	01 04	5.6	W	16.1	27 03	1015.9
46026	37.8N	122.7W	0738	14.0	13.9	1.1	2.3	24 12	7.9	NW	23.1	17 04	1016.7
46027	41.9N	124.4W	0737	12.4	12.1	1.6	3.9	24 03	6.9	N	27.4	31 23	1017.3
46028	35.8N	121.9W	0742	15.6		1.6	3.2	24 16	10.3	NW	25.6	07 03	1016.2
46029	46.2N	124.2W	0742	13.4	11.6	1.5	4.5	23 21	8.3	S	23.7	23 22	1019.0
46030	40.4N	124.5W	0741	12.2	11.3	1.3	2.8	25 05	9.5	N	20.2	10 21	1016.8
46035	57.0N	177.7W	0725	5.3	6.8	3.2	7.3	26 11	16.3	W	38.5	03 11	1001.9
46041	47.4N	124.5W	0731	11.4	11.7	1.5	4.5	23 13	6.1	SE	25.3	22 16	1019.1
46042	36.8N	122.4W	0739	14.6		1.5	2.9	17 10	9.3	NW	21.6	02 00	1016.8
46045	33.8N	118.5W	0738	18.3	19.0	0.6	1.3	18 02	5.3	SW	18.7	01 01	1014.7
46050	44.6N	124.5W	0733	12.1	11.9	1.7	4.7	23 21	7.6	N	18.3	23 21	1019.5
46053	34.2N	119.9W	0742	17.5	17.9	0.7	1.2	25 07	9.0	W	25.5	14 23	1014.6
46054	34.3N	120.5W	0744	16.2	16.7	1.3	2.7	24 23	13.3	NW	29.9	07 01	1015.6
51001	23.4N	162.3W	0738	25.2	26.6	2.5	4.5	26 13	13.0	NE	28.3	26 01	1015.4
51002	17.2N	157.8W	0741	27.0	27.8	2.0	3.1	08 20	12.6	E	20.7	16 06	1012.3
51003	19.2N	160.8W	0744	26.3	27.9	2.1	4.6	27 03	11.6	E	22.5	03 16	1012.3
51004	17.4N	152.5W	0738	26.4	27.1	2.0	3.4	27 16	12.9	E	19.8	30 17	1012.2
51026	21.4N	157.0W	0740	25.4	26.7	2.0	3.9	26 22	12.4	E	21.8	26 13	1013.5
52009	13.7N	144.7E	0545		27.4	1.6	2.6	21 20	9.6	NE	24.5	06 16	1009.0
91222	18.1N	145.8E	0739	28.2					6.9	E	18.3	01 23	1010.5
91251	11.4N	162.4E	0729	28.1					9.8	E	34.2	20 16	1009.4
91328	8.6N	149.7E	0742	27.4					7.4	SW	28.0	23 01	1009.0

October, November and December 1993

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
91338	5.3N	153.7E	0743	27.5					7.5	SW	22.0	18/04	1009.2
91343	7.6N	155.2E	0742	27.6					3.7	SW	21.7	05/02	1008.8
91352	6.2N	160.7E	0740	27.6					6.5	SW	26.8	18/20	1009.7
91355	5.4N	163.0E	0740	27.4					8.1	SW	28.4	17/19	1009.0
91377	6.1N	172.1E	0739	28.1					6.5	N	26.2	18/00	1009.9
ABAN6	44.3N	075.9W	0743	8.6	13.1				5.0	S	17.6	01/17	1016.2
ALSN6	40.5N	073.8W	0742	13.1	14.6	1.0	2.9	12/15	16.0	NW	33.0	12/13	1019.0
BURL1	28.9N	089.4W	0742	22.7					11.3	N	43.1	30/05	1016.1
BUSL1	27.9N	090.9W	0744		28.3				13.1	NE	40.7	30/03	1015.7
BUZM3	41.4N	071.0W	0741	12.6					16.6	SW	40.3	31/04	1017.5
CARO3	43.3N	124.4W	0742	11.9					6.8	N	22.0	21/04	1017.9
CHLV2	36.9N	075.7W	0743	17.2					13.7	NE	43.2	27/04	1018.5
CLKN7	34.6N	076.5W	0743	20.5					12.9	NE	30.9	26/18	1017.7
CSBF1	29.7N	085.4W	0742	21.8					6.2	NE	24.5	30/08	1015.9
DBLN6	42.5N	079.4W	0743	10.6					12.5	SW	48.0	21/15	1016.7
DESW1	47.7N	124.5W	0742	11.4					7.7	SE	38.0	23/18	1018.8
DISW3	47.1N	090.7W	0740	5.5					13.3	W	38.4	07/13	1013.7
DPIA1	30.3N	088.1W	0740	21.3	23.5				10.9	NE	28.4	30/13	1016.3
DRYF1	24.6N	082.9W	0742	27.0					9.0	E	26.4	31/12	1014.7
DSLN7	35.2N	075.3W	0741	21.2	24.9	1.6	4.7	27/12	16.8	NE	54.6	27/07	1016.6
FBIS1	32.7N	079.9W	0743	20.1					9.9	NE	33.1	30/14	1016.9
FFIA2	57.3N	133.6W	0742	8.1					10.0	SE	37.4	20/08	1013.8
FPSN7	33.5N	077.6W	0399	22.1	24.7	1.6	4.3	30/16	17.1	NE	40.4	27/02	1015.4
FWYF1	25.6N	080.1W	0743	27.0	28.2				9.9	E	31.0	31/05	1015.2
GDIL1	29.3N	090.0W	0742	22.5	24.7				10.3	NE	32.7	30/11	1016.0
GLLN6	43.9N	076.5W	0721	10.0					17.3	S	42.6	22/05	1015.0
IOSN3	43.0N	070.6W	0743	9.8					14.4	W	31.5	31/04	1017.0
LONF1	24.9N	080.9W	0744	27.1	28.6				8.7	E	24.4	31/16	1014.7
MDRM1	44.0N	068.1W	0742	8.9					17.5	S	37.8	21/19	1016.4
MISM1	43.8N	068.9W	0744	8.9					16.8	SW	36.2	12/21	1016.8
MLRF1	25.0N	080.4W	0743	27.2	28.2				9.3	E	29.1	16/04	1014.2
NWPO3	44.6N	124.1W	0743	11.8					6.5	E	19.2	23/23	1019.1
PILM4	48.2N	088.4W	0741	4.6					15.9	NW	37.7	21/10	1013.7
PTAC1	39.0N	123.7W	0743	12.7					8.0	N	22.8	10/01	1016.9
PTAT2	27.8N	097.1W	0579	22.2	25.0				14.2	SE	30.9	30/07	1015.2
PTGC1	34.6N	120.7W	0743	15.4					11.7	N	29.0	03/03	1015.2
ROAM4	47.9N	089.3W	0738	4.4					15.0	SW	35.2	29/12	1013.9
SANF1	24.5N	081.9W	0722	27.0	28.2				10.9	E	26.7	31/17	1014.3
SAUF1	29.9N	081.3W	0744	22.9	25.5				10.2	NE	30.6	23/20	1016.0
SBIO1	41.6N	082.8W	0743	11.1					12.6	SW	41.3	21/12	1017.8
SGNW3	43.8N	087.7W	0743	8.2					12.0	S	31.9	09/11	1014.6
SISW1	48.3N	122.9W	0741	10.8					5.8	W	34.6	24/02	1019.0
SMKF1	24.6N	081.1W	0742	27.3	28.4				10.0	E	30.9	16/23	1015.1
SPGF1	26.7N	079.0W	0741	26.7	28.6				5.8	E	26.4	26/22	1016.5
SRST2	29.7N	094.1W	0712	21.3					9.4	N	25.8	30/05	1016.7
STDM4	47.2N	087.2W	0743	5.4					18.4	W	53.7	21/16	
SUPN6	44.5N	075.8W	0742	8.7	13.2				12.0	S	40.1	04/07	1015.4
SVLS1	32.0N	080.7W	0723	21.0					15.3	NE	38.1	26/15	1016.4
THIN6	44.3N	076.0W	0744	8.6									
TPLM2	38.9N	076.4W	0743	14.7	17.2				10.8	S	30.7	30/23	1018.3
TTIW1	48.4N	124.7W	0741	10.9					11.0	E	45.1	23/23	1019.0
VENF1	27.1N	082.5W	0641	23.9	27.0				8.1	NE	30.6	31/19	1015.4
WPOW1	47.7N	122.4W	0741	12.2					5.2	N	25.6	23/19	1019.1
NOVEMBER 1993													
32302	18.0S	085.1W	0717	18.2	18.7	2.2	3.6	21/04	14.1	SE	21.2	06/09	1016.3
41001	34.7N	072.7W	0718	19.8	22.6	2.2	5.7	01/05	15.0	NE	32.6	28/16	1020.5
41002	32.3N	075.2W	0718	21.6	23.8	2.2	5.4	27/17	14.1	NE	29.0	26/01	1019.6
41004	32.5N	079.1W	0713	19.2	23.0	1.6	4.3	26/01	14.8	N	31.1	26/00	1019.8
41006	29.3N	077.4W	0717	23.4	25.6	2.1	5.7	26/13	13.2	NE	31.7	22/15	1018.3
41009	28.5N	080.2W	1435	23.2	25.2	1.6	4.2	23/16	14.0	E	29.3	10/16	1018.3
41010	28.9N	078.5W	1434	23.7	25.6	1.9	4.6	26/12	13.1	NE	29.3	22/11	1018.5
41016	24.6N	076.5W	0718	26.3	28.3	0.5	1.3	01/12	11.9	E	25.0	30/08	1016.7
42001	25.9N	089.7W	0718	23.3	26.2	1.2	2.7	01/00	13.7	NE	29.0	10/13	1019.1
42002	25.9N	093.6W	0718	23.1	25.5	1.4	3.1	06/21	13.9	SE	28.2	06/20	1018.4
42003	25.9N	085.9W	0716	24.1	26.7	1.3	2.7	01/01	14.0	NE	25.5	10/19	1019.1
42007	30.1N	088.8W	0717	16.0	19.0				11.8	NE	27.4	20/10	1020.9
42019	27.9N	095.0W	0716	22.4	24.8	1.6	3.7	09/06	13.9	SE	27.7	20/04	1018.9
42020	27.0N	096.5W	0010	23.2	23.8	0.7	1.3	30/23	12.9	SE	16.1	30/21	1021.2
42025	25.0N	080.5W	0718	24.9	26.8	0.6	1.6	14/10					
42035	29.3N	094.4W	0715	16.6	19.3	1.0	2.6	09/03	13.1	E	27.6	06/07	1020.1
44004	38.5N	070.7W	0717	14.2	17.6	2.1	6.8	28/23	14.7	NE	33.4	28/20	1021.1
44005	42.7N	068.6W	0717	8.0	9.3	1.8	4.9	21/04	15.6	SW	32.3	21/04	1019.9
44007	43.5N	070.1W	0716	6.1	8.2	1.0	4.4	29/00	13.3	SW	32.8	28/22	1020.0
44008	40.5N	069.4W	0715	10.4	12.4	1.8	5.8	29/05	15.2	SW	36.3	02/00	1020.9
44009	38.5N	074.7W	0715	11.4	13.3	1.1	4.5	28/10	13.0	NW	29.9	01/21	1021.9
44013	42.4N	070.7W	0718	7.6	8.9	0.8	2.8	01/03	12.6	SW	29.1	02/05	1019.6
44014	36.6N	074.8W	0710	15.0	18.1	1.6	6.4	28/16					1020.8
44025	40.3N	073.2W	0717	9.8	11.8	1.4	6.5	28/18	13.3	SW	32.6	01/19	1020.7
45001	48.1N	087.8W	0068	3.8	5.2	1.1	2.1	02/22	13.7	S	23.5	03/04	1015.3
45002	45.3N	086.4W	0208	3.8	9.3	1.5	3.9	07/23	17.2	SW	29.9	07/21	1014.4
45004	47.6N	086.5W	0072	3.6	5.0	1.2	2.5	02/16	13.7	S	26.8	02/14	1015.5

October, November and December 1993

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA HR)	MEAN PRESS (MB)
45005	41.7N	082.4W	0378	6.7	8.5	0.7	2.1	01 01	13.9	SW	26.6	05 21	1019.1
45006	47.3N	089.9W	0180	1.1	4.7	1.6	4.1	05 05	11.5	SW	18.0	02 21	1013.5
45007	42.8N	087.1W	0227	4.3	6.8	1.2	3.5	06 02	14.3	S	25.6	07 23	1017.3
45008	44.3N	082.4W	0036	3.2	8.4	1.3	1.8	01 03	12.1	NW	17.5	01 12	1021.3
45010	43.0N	087.8W	0231	3.7	6.9	0.7	2.2	05 21	11.1	S	22.3	07 20	1016.9
46001	56.3N	148.2W	0713	6.6	8.1	3.6	7.1	05 17	19.2	W	33.4	14 10	1009.4
46002	42.5N	130.3W	0712	13.4	15.1	2.8	9.4	12 07	13.5	N	34.8	12 05	1022.7
46003	51.9N	155.9W	0715	7.0	8.0	3.8	8.9	30 01	18.7	W	37.3	04 21	1012.4
46005	46.1N	131.0W	0715	12.3	13.9	3.2	9.6	11 22	15.0	NW	35.6	11 18	1022.2
46006	40.9N	137.5W	0713	15.6	17.3	2.9	6.1	30 19	14.5	N	29.7	25 20	1024.4
46013	38.2N	123.3W	0715	13.0	14.0	2.1	5.5	12 17	11.2	N	31.7	11 21	1018.1
46014	39.2N	124.0W	0709	12.0	12.5	2.3	7.0	12 14	11.2	NW	31.5	11 23	1019.1
46022	40.8N	124.5W	0713	11.0	11.4	2.4	7.4	12 12	11.2	N	30.7	29 13	1019.7
46023	34.3N	120.7W	0400	16.0	16.8	2.1	5.0	13 05					1016.1
46025	33.8N	119.1W	0588	17.0	17.6				6.3	W	23.9	15 13	1017.6
46026	37.8N	122.7W	0716	13.1	13.6	1.4	3.5	11 23	10.3	NW	29.1	12 05	1018.9
46027	41.9N	124.4W	0709	10.2	10.1	2.2	6.0	12 10	10.1	N	28.4	01 01	1019.9
46028	35.8N	121.9W	0717	15.1		2.1	6.1	13 00	9.8	NW	30.5	14 14	1018.1
46029	46.2N	124.2W	0716	9.6	10.0	2.3	5.8	12 03	10.8	E	28.0	30 17	1022.0
46030	40.4N	124.5W	0715	10.9	10.8	2.1	6.0	12 13	12.3	N	28.4	29 11	1019.4
46035	57.0N	177.7W	0719	3.4	5.5	4.1	8.7	09 03	20.3	SW	46.0	09 05	998.0
46041	47.4N	124.5W	0702	8.2	10.4	2.2	5.3	12 12	9.4	SE	30.1	15 14	1021.8
46042	36.8N	122.4W	0716	13.9		2.0	4.9	13 06	11.0	NW	28.2	12 03	1018.7
46045	33.8N	118.5W	0711	16.5	17.1	0.6	2.6	12 11	6.2	W	20.2	14 19	1016.7
46050	44.6N	124.5W	0697	9.4	10.5	2.5	6.4	12 06	10.4	N	29.1	30 22	1022.9
46051	34.5N	120.7W	0315	15.3	15.5				21.8	NW	23.3	30 16	1019.3
46053	34.2N	119.9W	0719	16.4	17.0	0.9	2.5	11 23	8.1	W	30.7	30 16	1016.8
46054	34.3N	120.5W	0718	16.0	16.6	1.5	4.4	13 04	10.6	NW	29.3	14 13	1017.7
51001	23.4N	162.3W	0718	23.6	25.1	3.0	6.0	02 17	16.1	NE	27.6	23 22	1018.8
51002	17.2N	157.8W	0717	25.9	26.8	2.4	3.8	25 01	16.3	E	26.3	19 17	1014.2
51003	19.1N	160.8W	0717	25.3	26.7	2.5	4.6	24 19	14.7	NE	27.5	24 03	1014.6
51004	17.4N	152.5W	0716	25.3	26.5	2.5	3.8	19 19	15.6	NE	26.7	19 14	1015.2
51026	21.4N	157.0W	0716	24.0	25.5	2.7	4.8	03 17	15.8	E	25.6	20 03	1016.3
52009	13.7N	144.7E	0709		27.4	1.8	3.3	30 17	12.5	E	21.8	22 11	1009.4
91222	18.1N	145.8E	0718	27.5					7.9	E	21.3	10 13	1011.7
91251	11.4N	162.4E	0710	28.0					14.9	E	26.3	30 20	1009.4
91328	8.6N	149.7E	0700	27.8					5.9	NE	19.2	30 14	1008.3
91338	5.3N	153.7E	0717	28.1					3.5	SW	16.6	13 03	1007.7
91343	7.6N	155.2E	0715	27.9					5.4	NE	18.0	29 03	1007.7
91352	6.2N	160.7E	0716	27.6					4.9	E	18.3	03 15	1008.5
91355	5.4N	163.0E	0717	27.1					4.7	E	19.2	15 14	1007.8
91377	6.1N	172.1E	0716	27.9					6.5	NE	20.5	30 11	1009.6
ABAN6	44.3N	075.9W	0716	3.2	7.8				4.9	S	22.2	01 02	1019.5
ALSN6	40.5N	073.8W	0716	9.1	11.2	1.0	3.8	28 20	15.8	NW	40.0	01 22	1021.9
BURL1	28.9N	089.4W	0714	17.1					13.2	N	29.0	16 00	1020.6
BUSL1	27.9N	090.9W	0718		25.9				13.5	NE	35.4	09 16	1021.7
BUZM3	41.4N	071.0W	0717	8.8					16.8	SW	41.3	28 21	1020.1
CARO3	43.3N	124.4W	0717	8.2					8.4	NE	27.6	29 13	1021.2
CHLV2	36.9N	075.7W	0716	12.9					15.6	NE	45.7	28 07	1022.2
CLKN7	34.6N	076.5W	0717	15.2					12.9	NE	33.3	28 08	1021.7
CSBF1	29.7N	085.4W	0717	16.4					5.9	N	16.1	06 14	1020.4
DBLN6	42.5N	079.4W	0717	5.6					13.1	SW	39.9	06 00	1019.7
DESW1	47.7N	124.5W	0715	7.5					10.7	SE	39.6	03 06	1021.5
DISW3	47.1N	090.7W	0716	-0.4					15.2	S	38.8	05 04	1016.4
DPIA1	30.3N	088.1W	0713	15.2	16.3				11.1	N	24.6	07 03	1020.9
DRYF1	24.6N	082.9W	0717	24.8					13.3	NE	26.2	01 19	1017.3
DSLN7	35.2N	075.3W	0717	17.6	22.5	1.9	5.3	28 05	18.5	NE	43.4	28 09	1021.6
FBIS1	32.7N	079.9W	0715	15.0					8.7	NE	23.5	26 06	1021.2
FFIA2	57.3N	133.6W	0715	4.8					15.2	SE	46.2	20 23	1013.1
FPSN7	33.5N	077.6W	0657	18.5	21.9	1.6	3.9	26 08	18.6	NE	42.8	26 00	1020.3
FWYF1	25.6N	080.1W	0714	24.6	26.5				13.3	E	24.5	01 12	1017.5
GDIL1	29.3N	090.0W	0715	16.5	18.4				11.3	NE	29.8	06 09	1020.6
GLLN6	43.9N	076.5W	0716	4.7					16.3	SW	37.6	20 12	1018.4
IOSN3	43.0N	070.6W	0715	6.4					14.8	W	36.2	28 22	1019.2
LONF1	24.9N	080.9W	0716	24.0	25.2				11.7	N	24.2	02 03	1017.0
MDRM1	44.0N	068.1W	0718	6.4					18.8	SW	42.7	29 02	1016.6
MISM1	43.8N	068.9W	0717	6.1					18.0	SW	44.8	20 03	1018.9
MLRF1	25.0N	080.4W	0718	24.8	26.6				12.7	E	24.9	01 15	1016.5
NWPO3	44.6N	124.1W	0716	6.6					8.3	E	31.1	30 21	1022.5
PILM4	48.2N	088.4W	0715	-1.0					15.3	SW	44.2	19 22	1017.5
PTAC1	39.0N	123.7W	0716	11.1					9.2	N	27.1	14 05	1019.0
PTAT2	27.8N	097.1W	0716	16.4	18.3				11.9	N	29.2	06 07	1019.4
PTGC1	34.6N	120.7W	0715	15.2					10.3	N	36.3	14 14	1016.9
ROAM4	47.9N	089.3W	0715	-1.1					17.4	SW	41.4	19 21	1017.3
SANF1	24.5N	081.9W	0717	24.6	26.7				14.1	NE	25.9	02 07	1016.9
SAUF1	29.9N	081.3W	0716	18.3	19.9				11.9	N	31.0	23 09	1020.2
SBIO1	41.6N	082.8W	0715	5.3					13.7	SW	34.6	20 04	1020.8
SGNW3	43.8N	087.7W	0694	2.2	4.9				13.1	SW	31.5	27 17	1018.7
SISW1	48.3N	122.9W	0714	6.5					11.2	SE	41.2	23 06	1021.8
SMKF1	24.6N	081.1W	0717	24.5	26.5				13.9	NE	26.9	01 19	1017.4
SPGF1	26.7N	079.0W	0716	24.5	26.8				9.3	E	22.9	24 19	1019.1

October, November and December 1993

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
SRST2	29.7N	094.1W	0675	13.8					9.7	E	24.0	02/08	1020.8
STDM4	47.2N	087.2W	0711	0.1					18.1	SW	46.7	20/00	1018.7
SUPN6	44.5N	075.8W	0715	3.2	8.0				11.5	S	31.3	29/02	1018.7
SVLS1	32.0N	080.7W	0710	16.2					15.2	NE	39.6	26/05	1020.8
THIN6	44.3N	076.0W	0718	3.2									
TPLM2	38.9N	076.4W	0718	9.9	11.6				11.3	W	33.5	28/09	1021.7
TTIW1	48.4N	124.7W	0716	7.0					15.0	E	49.0	03/04	1021.4
VENF1	27.1N	082.5W	0691	20.5	22.3				8.6	NE	24.2	01/00	1019.0
WPOW1	47.7N	122.4W	0717	7.0					8.2	S	31.4	03/04	1022.2
DECEMBER 1993													
32302	18.0S	085.1W	0742	18.6	19.0	2.0	3.8	05/13	12.5	E	21.0	05/04	1014.6
41001	34.7N	072.7W	0743	16.2	20.9	3.0	7.7	05/21	16.5	W	37.5	05/20	1014.5
41002	32.3N	075.2W	0743	17.6	22.4	2.6	6.8	05/17	14.4	W	36.5	26/06	1016.1
41004	32.5N	079.1W	0740	14.3	20.9	1.4	3.9	05/07	14.9	W	35.2	05/10	1017.3
41006	29.3N	077.4W	0742	20.2	24.3	2.3	6.2	12/13	14.0	NE	30.3	11/10	1017.2
41009	28.5N	080.2W	1488	19.0	23.9	1.2	3.7	02/03	13.7	NW	29.5	26/05	1018.0
41010	28.9N	078.5W	1487	20.4	24.2	1.9	4.3	26/05	13.9	NW	32.1	15/16	1017.8
41016	24.6N	076.5W	0743	24.1	26.8	0.6	1.9	20/17	13.2	NE	27.0	11/11	1017.8
42001	25.9N	089.7W	0744	20.8	23.2	1.3	3.8	25/00	13.7	NE	35.6	24/21	1019.1
42002	25.9N	093.6W	0744	21.7	24.3	1.4	4.3	14/13	14.8	SE	35.9	24/17	1018.3
42003	25.9N	085.9W	0743	21.6	25.9	1.3	3.5	15/10	13.8	NE	29.1	25/04	1019.2
42007	30.1N	088.8W	0744	12.7	16.1				12.9	NE	26.4	05/01	1020.1
42016	29.9N	088.0W	0549	13.2	18.2				13.3	N	29.7	14/02	1019.3
42019	27.9N	095.0W	0741	20.9	23.0				14.5	SE	29.3	14/05	1018.8
42020	27.0N	096.5W	0742	20.1	22.4	1.5	3.9	24/14	14.5	SE	30.7	24/13	1018.4
42025	25.0N	080.5W	0743	22.1	25.2	0.6	1.9	02/07					
42035	29.3N	094.4W	0744	14.8	16.3	0.9	2.6	13/09	12.4	E	29.1	14/03	1019.7
42036	28.5N	084.5W	0533	16.4	20.2	1.2	3.8	15/10	12.8	NW	26.4	14/05	1018.0
44004	38.5N	070.7W	0744	10.0	15.8	2.9	8.5	17/00	16.6	NW	38.3	16/13	1013.7
44005	42.7N	068.6W	0742	3.8	7.9	2.6	7.3	17/01	16.4	N	36.7	16/17	1013.6
44007	43.5N	070.1W	0743	0.9	6.4	1.4	5.1	21/19	15.7	N	36.5	26/18	1015.0
44008	40.5N	069.4W	0741	5.9	9.5	2.5	7.1	16/23	17.0	N	43.7	06/07	1013.4
44009	38.5N	074.7W	0741	6.2	9.9	1.1	2.9	05/21	14.8	NW	40.8	05/20	1016.5
44013	42.4N	070.7W	0744	2.2	7.0	1.4	5.1	16/16	15.3	N	33.8	26/14	1014.2
44014	36.6N	074.8W	0742	9.0	13.2	2.0	5.7	17/17					1015.4
44025	40.3N	073.2W	0742	4.7	9.3	1.6	4.7	22/01	15.9	W	35.6	22/01	1015.2
46001	56.3N	148.2W	0285	4.6	6.7	3.6	5.9	06/11	16.3	SW	30.9	05/18	989.2
46002	42.5N	130.3W	0732	11.7	12.4	3.9	10.0	08/18	15.5	S	44.5	08/16	1016.2
46003	51.9N	155.9W	0740	4.8	5.9	4.8	9.3	17/03	19.4	SW	43.1	18/01	993.3
46005	46.1N	131.0W	0744	10.9	11.7	3.9	11.0	10/02	14.2	SW	37.7	09/20	1014.0
46006	40.9N	137.5W	0741	12.8	14.2	4.3	10.8	13/22	17.3	W	38.1	08/03	1017.2
46012	37.4N	122.7W	0715	12.3	13.3	2.6	5.6	11/15	11.3	NW	29.9	11/11	1020.3
46013	38.2N	123.3W	0741	11.1	12.8	3.0	6.7	14/18	12.3	SE	29.5	14/00	1020.0
46014	39.2N	124.0W	0742	11.3	12.3	3.0	6.1	10/18	10.8	SE	35.2	11/08	1020.3
46022	40.8N	124.5W	0340	11.5	12.0	4.0	7.0	09/05	16.1	S	38.5	10/13	1016.2
46025	33.8N	119.1W	0425	14.9	15.2				7.0	NW	21.8	15/04	1019.9
46026	37.8N	122.7W	0738	10.6	12.3	2.2	4.6	11/14	12.6	E	33.4	11/11	1020.9
46027	41.9N	124.4W	0738	10.5	11.0	3.1	7.9	10/15	11.5	SE	31.5	11/01	1018.6
46028	35.8N	121.9W	0542	13.5		3.3	6.5	15/12	11.7	NW	29.0	11/14	1019.6
46029	46.2N	124.2W	0734	9.3	8.8	3.2	8.7	10/10	14.3	E	38.6	10/05	1017.5
46030	40.4N	124.5W	0741	11.1	11.4	2.8	6.5	10/16	12.8	SE	37.5	13/18	1019.1
46035	57.0N	177.7W	0743	-0.5	3.6	3.5	8.6	25/14	17.9	N	41.6	25/09	994.8
46041	47.4N	124.5W	0724	7.4	8.5	3.0	7.2	10/12	12.1	SE	34.6	10/07	1017.2
46042	36.8N	122.4W	0735	12.4		2.7	5.5	15/06	10.7	E	30.3	11/13	1020.8
46045	33.8N	118.5W	0739	14.5	15.3	1.1	2.8	12/06	5.6	E	22.0	15/00	1018.6
46050	44.6N	124.5W	0214	10.0	10.0	4.2	7.7	02/06	18.5	S	42.9	08/21	1015.9
46051	34.5N	120.7W	0735	14.0	14.8				11.2	NW	29.9	11/16	1020.0
46053	34.2N	119.9W	0744	14.7	15.2	1.5	3.3	15/19	8.0	W	28.2	19/05	1018.8
46054	34.3N	120.5W	0743	14.4	14.8	2.4	5.7	15/14	12.0	NW	30.3	19/02	1019.7
51001	23.4N	162.3W	0742	22.7	23.8	3.1	5.6	02/22	15.4	NE	27.1	05/07	1019.0
51002	17.2N	157.8W	0743	24.7	25.1	3.1	5.2	06/07	18.5	E	29.0	06/07	1014.8
51003	19.1N	160.8W	0741	24.5	25.7	2.8	4.8	04/04	13.8	E	24.2	06/01	1015.2
51004	17.4N	152.5W	0744	24.4	25.6	3.0	4.8	05/12	18.0	NE	29.3	17/16	1016.0
51026	21.4N	157.0W	0739	23.2	24.1	3.1	5.0	03/13	15.8	E	26.8	04/00	1018.0
52009	13.7N	144.7E	0700		26.5	2.4	3.5	10/23	15.9	SE	24.5	04/13	1009.7
91222	18.1N	145.8E	0738	27.0					8.4	E	17.8	31/03	1012.6
91251	11.4N	162.4E	0578	27.5					18.7	NE	33.5	04/16	1009.5
91328	8.6N	149.7E	0743	27.4					10.0	NE	22.5	21/06	1008.3
91338	5.3N	153.7E	0744	27.8					6.4	NE	21.2	09/15	1006.6
91343	7.6N	155.2E	0742	27.5					13.4	NE	28.0	31/04	1007.2
91352	6.2N	160.7E	0723	27.5					10.0	NE	25.6	04/11	1008.0
91355	5.4N	163.0E	0739	27.3					7.8	NE	23.1	17/03	1006.8
91377	6.1N	172.1E	0741	27.9					10.6	NE	29.8	03/23	1008.8
ABAN6	44.3N	075.9W	0742	-3.5	5.2				4.9	S	20.6	16/17	1016.7
ALSN6	40.5N	073.8W	0743	3.4	8.3	1.0	2.9	21/17	16.9	NW	42.1	26/08	1016.7
BURL1	28.9N	089.4W	0739	13.7					13.9	N	33.2	14/00	1020.0
BUSL1	27.9N	090.9W	0744		23.9				13.9	NE	32.6	13/14	
BUZM3	41.4N	071.0W	0739	2.9					16.8	N	46.2	22/03	1014.3
CARO3	43.3N	124.4W	0743	8.5					10.7	S	42.0	10/07	1018.0
CHLV2	36.9N	075.7W	0743	7.1					15.7	N	43.7	05/22	1017.2

October, November and December 1993

BUOY	LAT	LONG	OBS	MEAN AIR TP (C)	MEAN SEA TP (C)	MEAN SIG WAVE HT (M)	MAX SIG WAVE HT (M)	MAX SIG WAVE HT (DA/HR)	SCALAR MEAN WIND SPEED (KNOTS)	PREV WIND (DIR)	MAX WIND (KTS)	MAX WIND (DA/HR)	MEAN PRESS (MB)
CLKN7	34.6N	076.5W	0744	9.2					12.2	N	33.8	05/14	1017.7
CSBF1	29.7N	085.4W	0738	12.3					6.8	NE	28.2	25/20	1019.7
DBLN6	42.5N	079.4W	0744	-0.3					13.7	S	45.8	26/09	1016.8
DESW1	47.7N	124.5W	0738	7.2					14.8	SE	49.0	08/22	1016.7
DISW3	47.1N	090.7W	0742	-4.5					13.0	S	34.0	25/09	1015.3
DPIA1	30.3N	088.1W	0739	11.9	13.6				11.5	N	33.0	14/01	1020.0
DRYF1	24.6N	082.9W	0741	21.6					12.8	NE	29.7	25/10	1018.1
DSLN7	35.2N	075.3W	0741	10.0	14.8	2.0	4.9	05/18	18.0	N	52.1	05/18	1017.1
FBIS1	32.7N	079.9W	0742	9.9					7.9	W	26.6	05/07	1018.7
FFIA2	57.3N	133.6W	0741	4.4					15.6	SE	40.3	17/14	1006.7
FPSN7	33.5N	077.6W	0634	12.6	21.4	1.5	4.4	05/10	18.0	N	50.8	05/11	1017.6
FWYF1	25.6N	080.1W	0742	21.5	24.9				13.3	NW	32.0	02/03	1018.1
GDIL1	29.3N	090.0W	0740	13.6	15.5				11.1	NE	26.3	21/08	1020.0
GLLN6	43.9N	076.5W	0744	-0.9					16.0	NE	43.6	22/10	1015.2
IOSN3	43.0N	070.6W	0741	0.9					17.3	W	47.0	06/00	1014.0
LKWF1	26.6N	080.0W	0277	18.1	23.6				9.6	NW	19.0	30/22	1019.9
LONF1	24.9N	080.9W	0740	20.1	22.3				10.4	NE	27.4	25/11	1017.8
MDRM1	44.0N	068.1W	0683	2.2					20.6	N	50.5	21/21	1038.3
MISM1	43.8N	068.9W	0741	1.0					19.3	N	49.6	21/21	1013.6
MLRF1	25.0N	080.4W	0743	21.7	24.8				13.1	N	29.0	25/12	1017.1
NWPO3	44.6N	124.1W	0743	7.4					10.9	E	44.7	08/23	1018.8
PILM4	48.2N	088.4W	0640	-3.1					13.1	NW	33.4	25/12	1015.1
PTAC1	39.0N	123.7W	0744	9.8					9.6	SE	36.6	13/23	1020.5
PTAT2	27.8N	097.1W	0442	18.5	17.7				11.1	SE	24.5	13/06	1016.8
PTGC1	34.6N	120.7W	0744	13.3					10.8	N	31.4	02/11	1019.1
ROAM4	47.9N	089.3W	0739	-5.5					16.0	NW	38.3	29/03	1015.9
SANF1	24.5N	081.9W	0743	21.4	24.9				14.3	NE	32.1	25/12	1017.7
SAUF1	29.9N	081.3W	0741	12.8	16.1				9.2	NW	28.1	01/22	1019.4
SBIO1	41.6N	082.8W	0744	-0.2					13.5	SW	37.9	30/03	1018.6
SGNW3	43.8N	087.7W	0743	-2.4	2.9				12.1	NW	30.1	13/01	1017.5
SISW1	48.3N	122.9W	0743	6.3					11.8	SE	45.7	13/06	1017.5
SMKF1	24.6N	081.1W	0743	21.1	24.3				13.9	NE	32.0	25/12	1018.1
SPGF1	26.7N	079.0W	0742	21.4	24.9				8.7	E	25.7	25/07	1018.6
SRST2	29.7N	094.1W	0709	12.3					9.3	NE	20.9	13/08	1020.4
STDM4	47.2N	087.2W	0742	-3.3					18.1	S	44.6	29/16	1027.7
SUPN6	44.5N	075.8W	0742	-3.5	4.0				9.3	S	27.5	26/18	1015.9
SVLS1	32.0N	080.7W	0727	11.0					14.4	W	36.0	05/09	1018.9
THIN6	44.3N	076.0W	0742	-3.6									
TPLM2	38.9N	076.4W	0743	3.8	6.3				12.1	NW	36.3	22/00	1017.1
TTIW1	48.4N	124.7W	0743	7.0					17.5	E	51.6	10/08	1016.6
VENF1	27.1N	082.5W	0742	15.7	17.9				8.8	NE	25.3	15/09	1019.3
WPOW1	47.7N	122.4W	0743	6.6					7.3	S	33.5	09/04	1018.3

Port Meteorological Services

SEAS Field Representatives

Mr. Robert Decker
Seas Logistics/ PMC
7600 Sand Point Way N.E.
Seattle, WA 98115
206-526-4280
FAX: 206-526-6365
TELEX 6735154/BOBD

Mr. Steven Cook
SEAS Operations Manager
8604 La Jolla Shores Dr.
La Jolla, CA 92037
619-546-7103
FAX: 619-546-7003
TELEX 6735179/ COOK

Mr. Robert Benway
National Marine Fisheries Service
28 Tarzwell Dr.
Narragansett, RI 02882
401-782-3295
FAX: 401-782-3201

Mr. Jim Farrington
SEAS Logistics/ A.M.C.
439 West York St.
Norfolk, VA 23510
804-441-3062
FAX: 804-441-6495
TELEX7635011/ MAPA

Mr. Warren Krug
Atlantic Oceanographic & Met. Lab.
4301 Rickenbacker Causeway
Miami, FL 33149
305-361-4433
FAX: 305-361-4582
TELEX 6735213 LORI

DMA Representatives

Tom Hunter DMA/HTC Rep.
ATTN: MCC 3 (Mail Stop D44)
4600 Sangamore Rd.,
Bethesda, MD 20816
301-227-3370

Walt Holgren
DMA/HTC Gulf Coast Rep.
One Canal Place
365 Canal St., suite 2300
New Orleans, LA. 70130
504-589-2642

Gary Rogan
DMA/HTC West Coast Rep.
2518 B Custom House
300 South Ferry St.
Terminal Island, CA 90731
310-514-6177

Port Met. Services

Northwest England
Captain Jim Williamson, PMO
Room 218, Royal Liver Building
Liverpool L3 1HU
Tel: 051-236 6565 FAX: 051-227 4762

Scotland and Northern Ireland
Captain Mike Bechley, PMO
Navy Buildings, Eldon St.
Greenock, Strathclyde PA16 7SL
Tel: (0475) 724700 FAX:(0475) 892879

Bristol Channel
Captain Archie F. Ashton, PMO
Cardiff Weather Centre
Southgate House, Wood Street
Cardiff CF1 1EW
Tel: Cardiff(0222) 221423
FAX: (0222) 390435

Southwest England
Captain Douglas R. McWhan, PMO
8 Viceroy House, Mountbatten Centre
Millbrook Rd. East,
Southampton SO1 OHY
Tel: Southampton (0703) 220632
FAX: (0703) 337341

Southeast England
Captain Clive R. Downes, PMO
Daneholes House, Hogg Lane
Grays, Essex RM17 5QH
Tel: Grays Thurrock (0375) 378369
FAX: (0375) 379320

Northeast England
Captain Graham Bell, PMO
Room D418 Corporation House
73-75 Albert Road
Middlesbrough, Cleveland TS1 2RZ
Tel: Middlesbrough (0642) 231622
FAX: (0642) 242676

East England
Captain John Steel, PMO
Customs Bldg, Albert Dock
Hull HU1 2DP
Tel: Hull (0482) 20158
FAX: (0482) 28957

New Zealand
Julie Fletcher, PMO
Met. Service of New Zealand Ltd.
Tahi Rd., PO Box 1515
Paraparaumu Beach, New Zealand
Tel: 64 4 2973237 FAX: 64 4 2973568

Japan
S. Sasanara, PMO
Yokohama Local Met. Observatory
Yamate-cho, Naka-ku, Yokohama
Tel: (045)-621-1991

M. Miyauchi
Japan Meteorological Agency
Otemachi, Chiyoda-ku
Tokyo, 100 Japan
Tel: (03)-212-8341

Hong Kong
Sui Fui Ip, PMO
Royal Observatory Ocean Centre Office
Room 1454, Straight Block
14/F Ocean Centre, 5 Canton Road
Tsim Sha Tsui, Kowloon, Hong Kong
Tel: 9226 3113 FAX 852 375-7555

Germany
Henning Hesse, PMO
Wetterwarte, An der neuen Schleuse
Bremerhaven Tel: (0471) 72220

Jurgen Guhne, PMO
Deutscher Wetterdienst
Seewetteramt
Bernhard Nocht-Strasse 76
20359 Hamburg
Tel: (040) 3190 8826

Kenya
Ali Juma Mafimbo, PMO
PO Box 98512
Mombasa, Kenya
Tel: (11) 25685 or 433440

Saudi Arabia
Mahmud Rajkhan, PMO
Met. and Envir. Protection Admin.
PO Box 1358 Jeddah
Tel: (020) 683-4444 ext. 325

Singapore
Edmund LEE Mun San, PMO
Meteorological Service, PO Box 8
Singapore Changi Airport
Singapore 9181 Tel: 5457198

France
Yann Prigent, PMO
Station Mét., Noveau Semaphore
Quai des Abeilles, Le Havre
Tel: 35.42.21.06

P. Coulon
Station Météorologique
de Marseille-Port
12 rue Sainte Cassien
13002 Marseille
Tel: 91.91.46.51, poste 336

South Africa
C. Sydney Marais, PMO
Roggebaai, Capetown, 8012
Tel: (021) 217543

Gus McKay, PMO
Meteorological Office
Louis Botha Airport
Durban 4029

Australia
M. Hills, PMA
Pier 14, Victoria Dock
Melbourne, Vic.
Tel: (03) 629 1810

Captain Alan H. Pickles, PMA
Stirling Marine, 17 Mews Road
Fremantle, WA 6160
Tel: (09) 335 8444 Fax: (09) 335 3286.
Telex: 92821

E.E. Rowlands, PMA
NSW Regional Office
Bureau of Meteorology
580 George St., Sydney, NSW 2000
Tel: (02) 269 8555 FAX: (02) 269-8589

Greece
George E. Kassimidis, PMO
Port Office, Piraeus
Tel: (00301) 4135502
(00301) 9628942

China
YU Zhaoguo
Shanghai Meteorological Bureau
166 Puxi Road
Shanghai, China

Malaysia
NG Kim Lai
Assistant Meteorological Officer
Malaysian Meteorological Service
Jalan Sultan, 46667 Petaling
Selangor, Malaysia

Mauritius
Goonasilan Soopramania
Principal Meteorological Tech.
Meteorological Services
St. Paul Road
Vacoas, Mauritius

Poland
Jozef Kowalewski
PMO, Gdynia and Gdansk
Inst. of Meteorology and Water Mgmt.
Marine Branch
81-342 Gdynia ul. Waszingtonia 42

Norway
Tor Inge Mathiesen, PMO
DNMI-Vervarslonga På Vestlandet
Allègt 70
5007 Bergen, Norway

Sweden
Morgan Zinderland
SMHI
S-601 76 Norrköping, Sweden

Denmark
PMO, Danish Meteorological Instit.
Lynbyvej 100
Copenhagen, Ø, Denmark

Netherlands
John W. Schaap, KNMI, PO Box 201
3730 A.E. DeBilt, Netherlands
Tel: (31) 30 206 391
FAX: (31) 30 210 849

Atlantic Ports

Charles E. Henson, PMO
National Weather Service, NOAA
2550 Eisenhower Blvd, No. 312
PO Box 165195, Port Everglades, FL 33316
305-463-4271 FAX/Tel: 305-462-8963

Lawrence Cain, PMO
National Weather Service, NOAA
Jacksonville International Airport
Box 18367, Jacksonville, FL 32229
904-741-4370

PMO, Norfolk
National Weather Service, NOAA
Norfolk International Airport
Norfolk, VA 23518
804-441-6326 FAX: 804-441-6495

James Saunders, PMO
National Weather Service, NOAA
BWI Airport, Baltimore, MD 21240
410-850-0529 FAX: 410-859-5129

Martin Bonk, PMO
National Weather Service, NOAA
Bldg. 51, Newark International Airport
Newark, NJ 07114 Tel: 201-645-6188

PMO, New York
National Weather Service, NOAA
Bldg. 51, Newark International Airport
Newark, NJ 07114 Tel: 201-645-6188

Randy Sheppard, PMO
Environment Canada
1496 Bedford Highway, Bedford
(Halifax) Nova Scotia B4A 1E5
902-426-6703

Denis Blanchard
Environment Canada
100 Alexis Nihon Blvd., 3rd Floor
Ville St. Laurent, (Montreal) Quebec
H4M 2N6 Tel: 514-283-6325

D. Miller, PMO
Environment Canada
Bldg. 303, Pleasantville
P.O. Box 21130, Postal Station "B"
St. John's, Newfoundland A1A 5B2
709-772-4798

Gulf of Mexico Ports

John Warrelmann, PMO
National Weather Service, NOAA
Int'l Airport, Moisant Field, Box 20026
New Orleans, LA 70141
504-589-4839

James Nelson, PMO
National Weather Service, NOAA
Houston Area Weather Office
1620 Gill Road, Dickinson, TX 77539
713-534-2640 FAX: (713) 337-3798
Internet:Jnelson@smtpgate.ssmc.noaa.gov

Pacific Ports

PMO, W/PRx2
Pacific Region, NWS, NOAA
Prince Kuhio Fed. Bldg., Rm 411
P.O. Box 50027
Honolulu, HI 96850
808-541-1670

Robert Webster, PMO
National Weather Service, NOAA
501 West Ocean Blvd.
Room 4480
Long Beach, CA 90802-4213
310-980-4090 FAX: 310-980-4089
TELEX: 7402731/BOBW UC

Robert Novak, PMO
National Weather Service, NOAA
1301 Clay St. Suite 1190N
Oakland, CA 94612-5217
510-637-2960 FAX 510-637-2961
TELEX: 7402795/WPMO UC

David Bakeman, PMO
National Weather Service, NOAA
7600 Sand Point Way, N.E.
Seattle, WA 98115
206-526-6100

Bob McArter, PMO
Environment Canada
700-1200 W. 73rd Av.
Vancouver, British Columbia
V69 6H9
604-664-9136

Duane Carpenter OIC
National Weather Service, NOAA
P.O. Box 190037
Kodiak, AK 99619
907-487-2102/4338

Lynn Chrystal, OIC
National Weather Service, NOAA
Box 427, Valdez, AK 99686
907-835-4505

Marine Program Mgr. W/AR121x3
Alaska Region
National Weather Service
222 West 7th Avenue #23
Anchorage, AK 99513-7575
907-271-5121

Great Lakes Ports

Bob Collins, PMO
National Weather Service, NOAA
333 West University Dr.
Romeoville, IL 60441
815-834-0600 FAX: 815-834-0645

George Smith, PMO
National Weather Service, NOAA
Hopkins International Airport
Federal Facilities Bldg.
Cleveland, OH 44135
216-265-2374

Ron Fordyce, Supt. Marine Data Unit
Rick Shukster, PMO
Keith Clifford, PMO
Environment Canada
Port Meteorological Office
100 East Port Blvd.
Hamilton, Ontario L8H 7S4
905-312-0900
Fax: 905-312-0730

U.S. Headquarters

Vincent Zegowitz
Marine Obs. Program Leader
National Weather Service, NOAA
1325 East West Highway
Silver Spring, MD 20910
301-713-1724

Martin Baron
VOS Program Manager
National Weather Service, NOAA
Room 17345
1325 East West Highway
Silver Spring, MD 20910
301-713-1724

Richard DeAngelis, Editor
Mariners Weather Log, NODC
1825 Connecticut Av., NW
Washington, DC 20235
202-606-4561
Fax: 202-606-4586
Internet: angel@nodc.noaa.gov

United Kingdom Headquarters

Captain Gordon V. Mackie,
Marine Superintendent, BD (OM)
Meteorological Office Met O (OM)
Scott Building, Eastern Road
Bracknell, Berks RG12 2PW
Tel:(0344) 855654 Fax: (0344)
855921
Telex: 849801 WEABKA G

Australia Headquarters

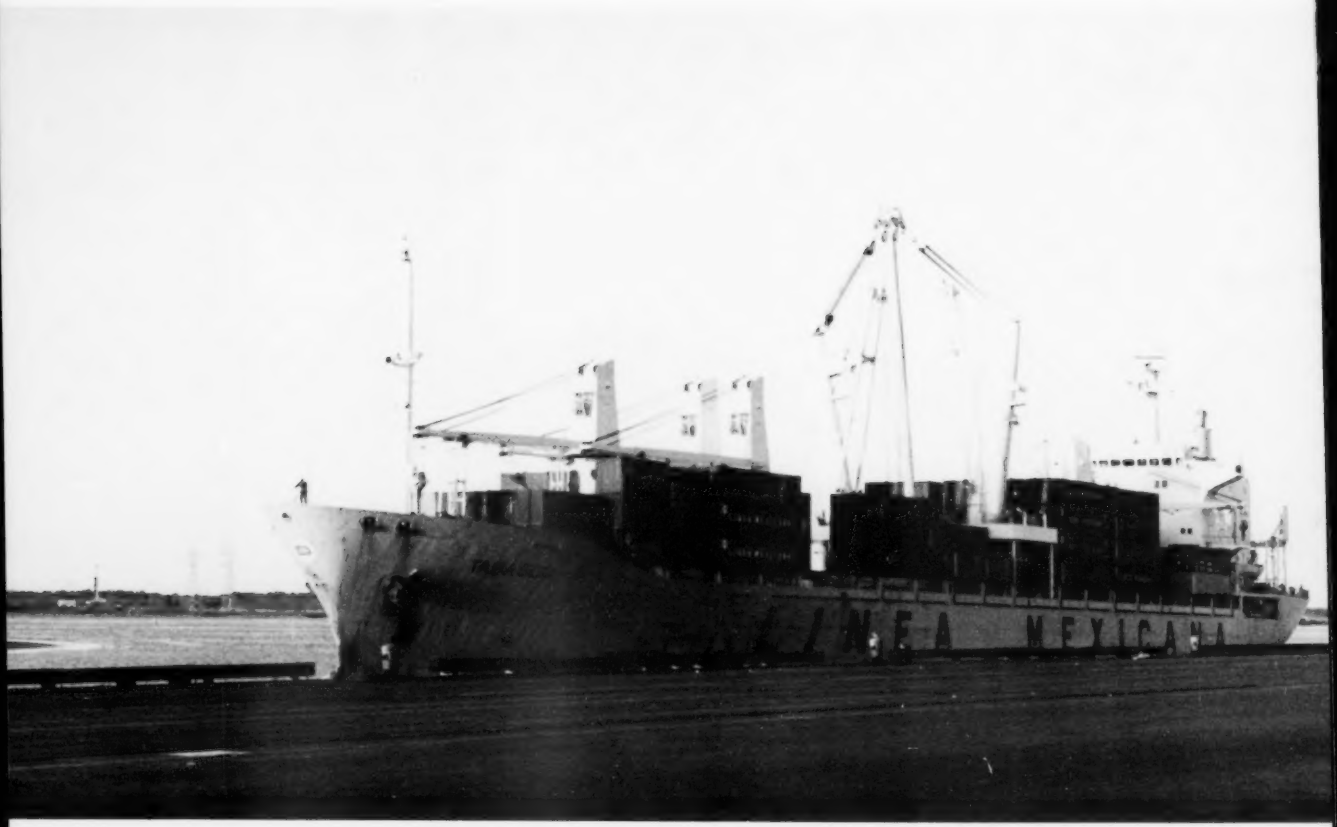
A.D. Baxter, Headquarters
Bureau of Meteorology
Regional Office for Victoria, 26 floor
150 Lonsdale Street
Melbourne, Vic 3001`
Tel: (03) 669 4000

Tropical Cyclone Names
for the Northern Hemisphere 1994 Season

North Atlantic	Eastern Pacific	Western N. Pacific		Central N. Pacific
Alberto	Aletta	Owen	Pat	Li
Beryl	Bud	Page	Ruth	Mele (MEH-leh)
Chris	Carlotta	Russ	Seth	Nona (NOH-nah)
Debby	Daniel	Sharon	Thelma	Oliwa (oh-LEE-vah)
Ernesto	Emilia	Tim	Verne	Paka (PAH-kah)
Florence	Fabio	Vanessa	Wilda	Upana (oo-PAH-na)
Gordon	Gilma	Walt	Yuri	Wene (WHE-neh)
Helen	Hector	Yunya	Zelda	
Isaac	Ileana	Zeke		
Joyce	John	Amy		
Keith	Kristy	Brendan		
Leslie	Lane	Caitlin		
Michael	Miriam	Doug		
Nadine	Norman	Ellie		
Oscar	Olivia	Fred		
Patty	Paul	Gladys		
Rafael	Rosa	Harry		
Sandy	Sergio	Ivy		
Tony	Tara	Joel		
Valerie	Vicente	Kinna		
William	Willa	Luke		
	Xavier	Mireille		
	Yolanda	Nat		
	Zele	Orichid		

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
1315 East West Highway
Distribution Unit
Silver Spring, MD 20910
ATTN: Mariners Weather Log

40

Address Correction Requested
OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

Book Rate